SCIENTIFIC AMERICAN

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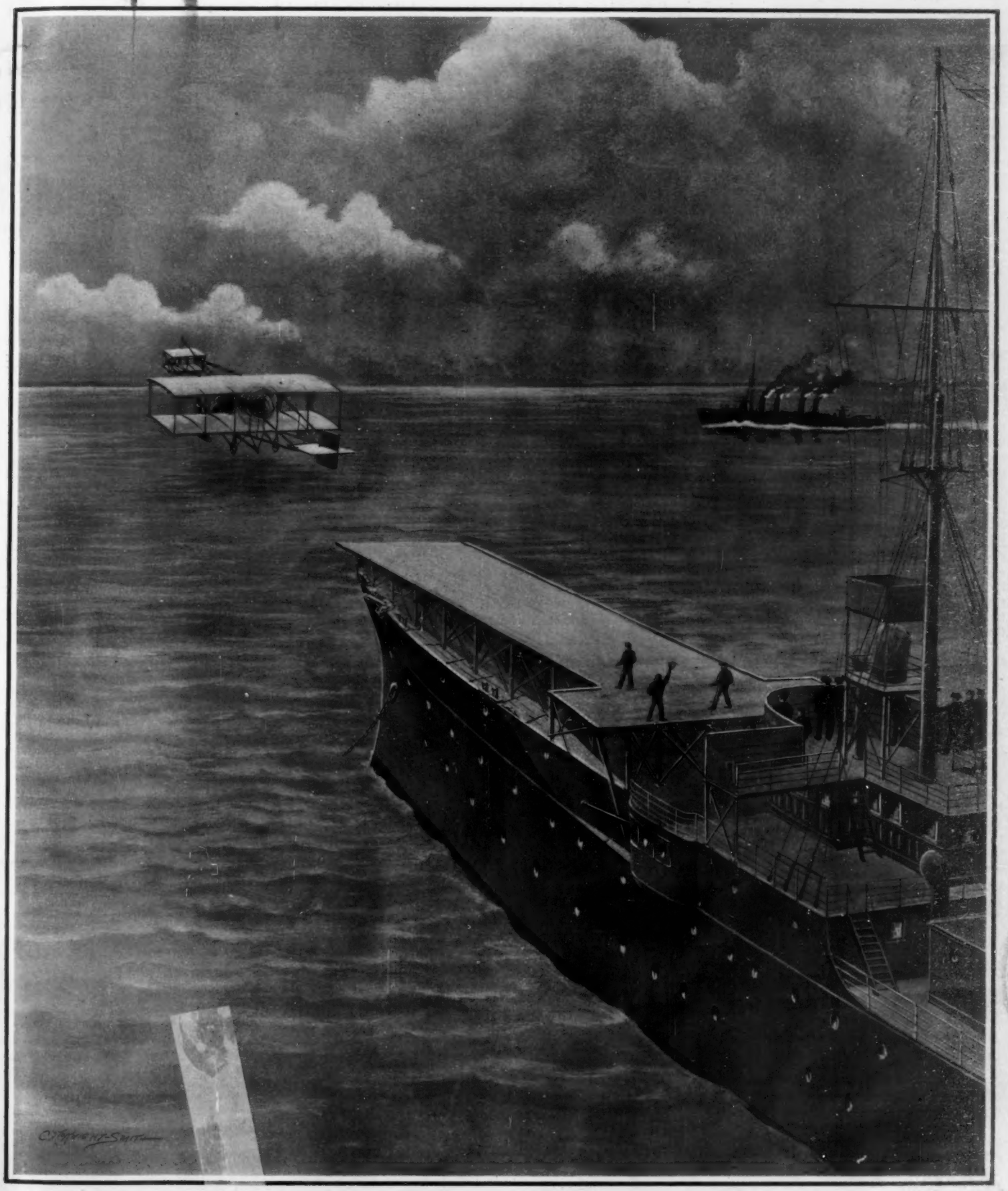

ELY'S FLIGHT IN A CURTISS BIPLANE FROM THE FORWARD DECK OF THE CRUISER "BIRMINGHAM" IN HAMPTON ROADS, VA.—[See page 418.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, NOVEMBER 26th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE LANGUAGE OF FLYING.

IT is with the strongest indorsement that we publish in our correspondence columns the letter of Mr. Henry A. Wise Wood, of this city, suggesting that, since human flight was first accomplished by an American, an effort should be made to set the language of flight upon an all-English-American basis.

That was a notable day in the history of transportation when the first clumsily fashioned pair of wooden wheels creaked upon their wooden axles, and primitive man exchanged the sliding contact of the sled for the rolling contact of the wheel. Notable also were the days when man first propelled himself by floating log and dipping paddle, by wind-filled sail, and last, by steam-driven propeller, across the once seemingly unconquerable seas. Difficult feats each one of these, and each, in its turn, a marvelous accomplishment in the eyes of contemporary witnesses. But we venture to affirm that when some future history of transportation, dated, say, in the year 2000, comes to be written, the flight of the Wright brothers among the sand dunes of North Carolina will be pronounced the most daring and difficult feat of all. It will never be spoken of as the most important or most valuable, for there are certain fundamental limitations to flight through the air, which will prevent either the flying machine or the airship from exerting the enormous influence on human life which resulted from the introduction of the rolling carriage, the sailing and the steam ship.

Therefore, we affirm that outside of considerations of utility and convenience, there are the strongest patriotic grounds for seeking to identify this latest and most marvelous of all feats of transportation and travel with the land of its birth. One of the best ways to accomplish this is to insure that the nomenclature of the new art be identified with the language of the people among whom it had its birth. Already a foreign terminology is being forced upon us; and many an American and Englishman is wrestling with "aileron," "epinage," "hangar," and "volplane," in a way that is strongly reminiscent to some of us of the earlier linguistical anxieties over "chauffeur," "garage," "chassis," and other French importations in the days of automobile development.

AN OLD HIGH-EXPLOSIVE FALLACY.

WE had thought that the old-time idea, that a considerable charge of high explosive, if detonated against armor plate, would produce very disastrous effects, had itself been long ago exploded; but the recent tests at Fort Monroe, when 200 pounds of nitro-glycerine was detonated against the turret and hull of the monitor "Puritan," show that the idea has even yet some attractions for Congress, by whose express order, we believe, the tests were made. A certain amount of damage was done to the old ship, it is true; but the effects do not begin to compare with those which could be obtained by utilizing the same amount of high explosive in the warhead of a torpedo, or within the cavities of high-explosive, 12-inch, armor-piercing shells.

Now all this was proved to demonstration a dozen years ago at the Sandy Hook proving ground of the United States army. At that time, Mr. Gathmann had succeeded in getting Congress to authorize a trial of his system, which consisted in firing large shells with thin walls, containing huge charges of guncotton, against armor plate; his theory being that the mere detonation of such heavy charges against the side armor of a warship would burst in the structure of the vessel, and send her incontinently to the bottom. An 18-inch gun (the largest bore ever attempted in modern ordnance) was built, and a shell containing, if we remember rightly, 500 pounds of guncotton, was fired against a 12-inch Harveyized plate. The results of the firing were pitifully small. At the same time, by way of comparison, a 12-inch armor-piercing shell, loaded with 18 or 20 pounds of maximite or dunnite, was fired against a similar 12-inch plate. The shell pierced the plate, and exploded just to the rear of it, tearing the backing and steel framing, representing the side structure of a battleship, into an indescribable wreckage of steel and timber. The results were so conclusive as to set at rest forever, one would have thought, the question as to how best to utilize high explosives against a warship.

However, there are some fallacies in naval matters that die hard, and this is evidently one of them; for an appropriation of $100,000 was made for this test. Regarding the results, it should be noted that their significance is materially lessened by the fact that the plates of the turret armor of the monitor are only 8 inches thick, as against 14 inches in our modern battleships, and they are old Harvey pure steel plates at that, and therefore in no way comparable with the superb Krupp steel plates in use to-day.

Admiral Mason, chief of the Bureau of Naval Ordnance, states that although the 8-inch armor of the turret against which 200 pounds of explosive gelatine was placed and detonated, was considerably bent and cracked, there is no evidence that the turret was in any sense vitally damaged. The second charge, detonated against the 10-inch side armor, buckled the plate, springing its edges outward, so that the seams at the ends, and at the lower edge of the plate where the latter is only 5 inches thick, were opened and a bad leak was started. The wider plates of a modern battleship's turret would have resisted buckling more effectually, and the longitudinal bulkheads, which are not present in the monitor, would have confined the incoming water within narrow limits.

But the futility of these experiments is seen when we remember that modern battleship engagements are carried on at from eight to ten thousand yards' range, and that if high explosives are to be used against the enemy, they must obviously be carried to him incased in the hardened steel walls of 12-inch projectiles—which is exactly the means employed at the present time. Even if we grant that 200 pounds of explosive gelatine detonated against the side of a modern dreadnought might start some trouble from leakage, who is going to put the deadly charge in position? How is he going to support it there? And by what means is he going to approach close enough to the ship for the purpose?

Let us hope, for the peace of mind of our ordnance experts, and for the relief of our already enormous naval expenditure, that this monitor experiment will see the last of Congressional appropriations for amateur experiments of this kind.

THE NEW TRI-BOROUGH SUBWAY.

CHAIRMAN WILCOX of the Public Service Commission has replied to the criticisms which have been made of the plans for a new tri-borough subway route. He states that the city already possessed the Williamsburg and the Manhattan bridges, each costing from $22,000,000 to $25,000,000, which are practically useless unless they are made parts of a comprehensive system of transportation. The proposed route includes both of these bridges.

Commenting on the criticisms that the new roads are to be excessively costly, he points out that the cost of construction, including station finish, of the entire tri-borough system as contemplated is $147,500,000. Of this system the Center Street loop, costing $9,800,000, is nearly finished. The six sections of the Fourth Avenue subway, costing $15,000,000, will be finished within eighteen months. The Manhattan Bridge portion, costing not less than $25,000,000, is nearly finished. The Williamsburg Bridge, costing almost as much, is already finished.

The cost of these bridges does not come within the total cost of the tri-borough, for the policy of the city has been not to include cost of bridges as part of rapid transit and not to expect any revenue from bridges. The city is committed to these links of the system. They are admittedly the expensive and less profitable parts. Standing alone they represent stub ends. These subway links, and in large part the bridges, will be useless unless the comprehensive plan of which they are a part, the tri-borough system, shall be completed.

As single units they cannot be made to produce adequate income and no Board of Estimate, Rapid Transit Commission or Public Service Commission ever for a moment labored under the delusion that they would be worth building if the system of which they are a part should be abandoned. The reason for their construction was that they were links in a chain and a beginning had to be made somewhere.

The fundamental question is not therefore whether the city shall now begin the tri-borough system, but whether, having spent $25,000,000, it shall spend a further amount to complete the system. The increased size of the bore of the new subways will allow an increase in the width of the cars of the tri-borough over the Interborough of 16 per cent. The multiple stations of the tri-borough together with the methods of connection between express and local tracks will make possible the running of trains in less than 1 minute 30 seconds, as compared with 1 minute 48 seconds, which is the best that the Interborough is able to do because of the delay at stations. Consequently the tri-borough, although its cost will be 30 per cent more, will represent an increase in capacity on a conservative estimate of headway and car capacity of almost an identical per cent.

Considering the increase in width of cars and reduction of headway, three-way rush hour travel and three centers of short haul business, the indicated capacity of the tri-borough on the same basis of extreme congestion that now exists in the Interborough will be around 3,000,000 passengers per day. Engineers of the Rapid Transit Commission figured in advance that the extreme capacity of the present subway would be around 800,000 passengers per day. The actual traffic has exceeded the estimate of extreme capacity.

In 1899, when the present or Interborough subway was contracted for, the surface lines in New York County carried 360,000,000 passengers and the elevated 174,000,000. Fears may then have been felt that the subway would not develop its own traffic, yet in the year ended June 30th, 1910, in New York County the surface lines carried 430,000,000, the elevated 293,000,000 and the Interborough subway 269,000,000. With these figures in mind the argument that the tri-borough would afford unnecessary capacity, inasmuch as it would take most of those who now ride on the elevated and subway, falls to the ground.

WORK OF THE GEOLOGICAL SURVEY.

IT is said that, on one occasion, when a great railway system in the Northwest was selecting coal lands in the densely forested regions of Washington, the geologist in charge, having measured and calculated the dip of the strata, turned to his assistant, saying:

"Take your drill crew over to section thirteen and see if you don't find coal about the middle of the section."

Now the assistant, who knew that the geologist had never visited section thirteen, went off on what he deemed a wild-goose chase. When he arrived on the ground, the deep cover of undergrowth and soil prevented examination of the rocks. But he went to work, and in a short time sent his drill into a good bed of coal, great quantities of which have since been used to haul trains across the mountains. The assistant said afterward that he would drill into a cloud if that geologist told him that there was coal in it.

Although it is not always possible thus accurately to predict the discovery of minerals, it can be done with sufficient frequency and certainty to render valuable the mapping of soil and rock strata that is done all over the country by our Geological Survey. This work, first systematized in 1879, has progressed so far that much of the country has been plotted, examined, and mapped. The maps describe the contour or changes in elevation of the surface, the rainfall and drainage, and the geological formation, as well as the railways, roads, rivers, and political divisions.

It is doubtless true that there is no better trained or disciplined scientific corps in the world than that which has this task in hand. It is divided for field work into divisions. The first to cover the ground is the topographical, which, after laying out the country into quadrangles of a square degree each, surveys minutely everything within these boundaries, measuring the height of every hill and mountain, the depth of every valley, and the course, direction, and exact location of every watercourse or other feature. This provides the familiar "contour" map, in which points of equal elevation above sea level are connected by a line. The presence or absence of many lines in a small area indicates a steep slope or a gentle descent or a level plain.

After the topographical workers come the geologists, who examine soil and rocks, sink drills, examine borings, measure the dip of strata, and study the geological formation of the whole region. On the topographical map they plot the colors which, by international agreement, represent the various minerals.

Then come the hydrographers, who study the rainfall, the capacity of watercourses, the current and volume of rivers at all stages, the capacity of lakes and ponds—all that pertains to drainage.

An engineer having all these facts provided for him, is able almost at a glance to select a route for a railway or a canal, or to locate the best site for a storage reservoir.

ENGINEERING.

The Brazilian destroyer "Sergipe" has left Messrs. Yarrow's yard at Glasgow to start on her voyage to Brazil. The "Parana" left last week. These two vessels are the last of the ten destroyers ordered by the Brazilian government from Messrs. Yarrow, and their departure witnesses the completion of a most important and efficient addition to the Brazilian fleet. It is interesting to note that in spite of the firm's move from London to Glasgow during the early part of the execution of this contract, the vessels have been delivered some months before the contract date.

Twenty-three bids were recently made for the Tri-Borough subway of New York city. All of the twenty-three contractors were willing to do the work with the city's money. Seventy-seven bids in all were submitted. The bids received were for the construction of those parts of the Tri-Borough route which include the Broadway-Lexington Avenue subway, the Canal Street crosstown section, and the Broadway-Lafayette loop in Brooklyn. The bids were submitted on what is technically known as the unit basis, that is, on the estimated cost of excavation and other work by the cubic yard.

According to the findings of a Royal Commission appointed to investigate the present condition of the Leaning Tower of Pisa, it seems that instead of being supported on a massive foundation the tower rests on a ring-shaped masonry base, with an inner diameter of 24 feet 3½ inches, exactly the same as the inside diameter of the tower. The tower is about 177 feet high, and in 1829 is said to have been 14 feet 5 inches out of plumb; since that time its inclination has been increased by an additional 0.0055 foot per foot of its height. In 1834 an earthquake caused a deflection of about 5 inches.

A Milan firm has built a 26-ton experimental locomotive, with two axles which are driven by steam turbines, by means of gearing. Speed changing is effected by means of a crown wheel which carries several rows of teeth. The blades of the direct-action turbine are S-shaped and the motion is reversed by reversing the flow of steam. In the trials of this locomotive, which has a maximum horse-power of 100, the consumption of steam at 150 pounds pressure was always less than 35 pounds per horse-power, when the locomotive was moving either forward or backward, and the locomotive started without difficulty with a load which corresponded to required torque of 480 meter kilogrammes (3,544 foot pounds).

An English patent has been granted to S. O. Cowper-Coles for an armor plate. A number of steel bars or plates are arranged on edge in the casting box, vertically or at varying angles to one another, each piece being placed at right angles to the one below it. The pieces before introduction into the casting box may be coated with zinc by any convenient process, and each may be advantageously provided with a number of projections formed on the surface by punching or stamping, or, alternatively, perforated plates coated in the same manner may be employed. The box containing the pieces is then heated to a considerable temperature, when, finally, aluminium or aluminium alloy is poured into it and allowed to solidify. Subsequently, unless a self-hardening steel has been employed, the mass is quenched at a temperature which will insure the hardening of the embedded metal.

The International Geographical Congress of 1908 initiated an international inquiry into the world's supplies of iron ore. The total amount of known iron-ore resources of the world in millions of tons is as follows: The actual reserves are 12,000 millions for Europe, 9,855 millions for America, and for the world, 22,408 millions of tons. The potential reserves are 41,000 for Europe, 82,000 for America, and for the whole world a total of 123,377 million tons. The production of pig iron at present amounts to 60 million tons yearly, and on this basis the known ore resources will be exhausted in two hundred years.

In a recent number of Power, Mr. R. M. Neilson contributes a critical analysis of the gas turbine. He states that the probable limit of temperature to which the blades of an impulse turbine can be subjected without rapid erosion is 700 deg. C. Even with divergent nozzles, with a high temperature of admission to the nozzle the velocity of exit of the gas would be so high that the impact of the gas on the blade would heat it beyond that temperature. Thus if air at a pressure of 300 pounds abs., and a temperature of 2,000 deg. C. were expanded in an ideal nozzle to atmospheric pressure, the temperature of issue would be 693 deg. C., and velocity 5,290 feet per second. This striking the bucket of a turbine could overheat it even if the bucket had a velocity equal to half that of the gas. But the compressor difficulty is greater because even if the temperature were kept low enough for safety, the efficiency of the turbine is limited by the efficiency of the pump or compressor, and hence an efficient gas turbine cannot at the present day be constructed.

ELECTRICITY.

An enterprising central station manager has offered a premium of $3 to electrical contractors for every old house that is wired for electric lights, the object being to encourage contractors to solicit such business during the dull winter season.

The Erie Railroad has been experimenting with the new Edison storage battery car between West Orange and the junction of the Greenwood Lake branch at Forest Hill. It is planned to use these cars in regular service between these points, and from Forest Hill the passengers will be carried by the regular trains.

A British inventor has devised a new standard resistance unit for heavy currents. It consists of a glass tube filled with mercury and fitted with platinum terminals communicating with the mercury. The heat produced by a current passing through the mercury causes the latter to expand and rise in an auxiliary tube of fine bore, graduated in ohms.

The "oily" surface of aluminium, due to the coating of aluminium hydroxide, causes it to shed water better than copper. It has been found that aluminium wires are less liable to be coated with sleet, even though they are of larger diameter than the copper wires, and hence they are more serviceable and more reliable than copper, for transmission purposes, in regions exposed to sleet storms.

A wireless telegraph station fitted with the Telefunken system has been built near Rio Vermelho, at the entrance of the harbor of Bahia. The range guaranteed for this station is 400 miles, but it has been in communication with the station at Rio de Janeiro, 730 miles away, and with a vessel a thousand miles away. The station has a mast 197 feet high, and employs wave lengths of 600, 1,000, and 1,600 meters.

China is certainly waking up. An electric park has been opened at Darien (Dalny) in Manchuria. The purpose of the park is to increase traffic on the electric railway operated by the South Manchuria Railway Company. This line is eight miles long. First and second-class passengers are carried, the fares for which are 6 and 4 cents, respectively. Tickets good for an hour are sold at 8 and 5 cents, and thirty trip tickets for 75 and 50 cents. The park at the center of the town contains a menagerie, a theater, a roller-skating rink, a shooting gallery, and other up-to-date amusements. Admission, 2 cents.

The Imperial German Postal Department has conducted extensive experiments with various impregnating materials to preserve the life of telegraph poles. It finds that if zinc chloride is used, the life of the pole is about twelve years; with copper sulphate, it is fourteen years; with corrosive sublimate, seventeen years; while if treated with tar oil, the pole will last twenty-two years. The cost of treating the poles follows a reverse order, however. The zinc chloride costs 4 marks per year per cubic meter treated; copper sulphate, 3.5 marks; corrosive sublimate, 3.1 marks; and tar oil, 2.8 marks.

A press report states that in a recent lecture before the British Institute of Electrical Engineers, Signor Ferranti made a startling declaration to the effect that the weather of the island of Great Britain could be controlled by means of electricity. The entire island would have to be girded with an electrical "defense" capable of warding off the vapors of the sea and preventing them from precipitation on land. The sunlight hours could thus be increased as desired. The burden of the Weather Bureau is heavy enough now; how long would it last if it could be held really responsible for the rain that spoils one's picnic or week-end outing?

The Navy Department has been making experiments with electric cooking, with a view to introducing electrical ranges on warships. The tests show that electricity is slightly cheaper than coal for cooking purposes, and that the action was not only quicker but more thorough, owing to the fact that electrical heat could be distributed to better advantage and more uniformly than could the heat of a coal range. The conclusions of the investigators were that electricity is cleaner and more economical of time and of space, that it eliminated coal boxes, draft troubles, soot accumulation, and excessive heat in the galley, in addition to which it was more economical of operation.

The best form of splice for galvanized iron wire, according to a writer in Electrical World, is one in which the wire is twisted to form five complete turns in what is known as the neck of the splice, after which the splice is completed by means of four or five end turns, in which the end of each wire is turned in a close coil about a straight section of the other. Tests of various splices show that the end turns have very little holding power, but that most of the holding power is due to the turns in the neck, and that a joint with five properly made turns in the neck, will be as strong as the wire it is made of, and will yield but slightly at first until it is set, after which there is practically no yield up to the breaking point.

SCIENCE.

The Swiss Federal Council intends to invite all nations to a conference at Berne to revise the calendar. It is the idea to adopt an arrangement by which every year will be divided into exactly 52 weeks or 364 days. Naturally there must be intercalary days. New Year's Day will probably be some such extra day.

A telegram has been received at Harvard College Observatory from Capt. T. E. DeWitt Veeder, superintendent of the United State Naval Observatory, Washington, stating that Cerulli's comet was observed by Epps on November 11th, 5801 G. M. T. in the following position: R. A. 3h. 38m. 27.0s.; Dec. +8 deg. 9m. 11s. The comet was visible in a small telescope.

E. Savy has invented a machine for instantaneously converting liquid soap into solid soap to be used in bars or as a powder. As described in his patent, the apparatus comprises a rotatable drum containing channels to receive and divide the soap paste into fine flakes, and provided with means for the introduction of a cooling gas or liquid. Fitting closely against the side of this drum there revolves in the opposite direction a smaller cylinder with double walls, which acts as a hopper for the liquid soap paste. Steam or hot water is introduced between the walls, while the sides of the cylinder are pierced with circular openings coinciding with the channels in the large drum. Means are also provided for discharging the solidified soap from the drum in the form of a bar or bars.

The need of a definite radium standard, in which all results should be expressed, has been growing more and more acute. Scientific results are now expressed in many cases in terms of arbitrary radium standards kept in each laboratory, and it has been difficult to be certain of the accuracy of relative value of such standards. At the recent International Congress of Radiology and Electricity, held at Brussels, Prof. Rutherford pointed out the desirability of establishing an international radium standard. He showed that there is a considerable difference among the standards used by several important European laboratories. A special international committee was appointed to report to the Congress on the best means to be adopted to fix an international radium standard.

Halley's meteors are discussed in a letter which is published in Nature, and which was written to Dr. J. S. Lockyer by Prof. David Todd of the Amherst College Observatory. Prof. W. H. Pickering directed attention to the possibility of observing such meteors early last May, when the earth was at its nearest, not to the comet, but to the comet's orbit. Many astronomers watched for these meteors, and on the night of May 5th-6th, Prof. Todd made a balloon ascension for this purpose. Hardly more meteors than usual on a May night were seen, and none that appeared traceable to the Halley radiant. On October 18th the earth was closest to that region of Halley's orbit where the comet passed on March 13th-15th, 1910. Unfortunately, the moon was full at just that time, so that observations, if any were made, were probably more or less fruitless.

Prof. E. C. Pickering of Harvard informs us that from an examination of the photographs of the Harvard map of the sky, Miss A. J. Cannon has found that a new star appeared in the constellation Sagittarius on August 10th, 1899. Its approximate position for 1875 is R. A. = 18h. 12.2m. Dec. —25 deg. 14 min. A photograph taken on August 9th, 1899, shows no trace of this object, although adjacent stars of the magnitude 11.5 are seen. The outburst was very sudden, as on a photograph taken the next evening, August 10th, 1899, the Nova is a conspicuous object, magnitude 8.5. The light faded rapidly from magnitude 8.6 on August 25th to 10.5 on October 13th, 1899. After that the decrease was more gradual. The last photograph on which the new star is visible was taken in October, 1901, when the star was very faint, and about the thirteenth magnitude. This is the third new star discovered at Harvard in six weeks. Nova Sagittarii No. 2, which was found by Mrs. Fleming, preceded Nova Sagittarii No. 3 about 20m. and was south 2.3 deg.

The latest artificial compound invented to take the place of rubber comes from Germany. In making this artificial caoutchouc, erythrene (divinyl) is heated with or without the addition of agents which promote polymerization. For instance, 500 parts of erythrene are dissolved in benzene and the solution is heated in an autoclave for 10 hours at a temperature of 150 deg. C.; the solvent and other volatile substances are then removed by steam-distillation, leaving an elastic substance very similar to natural caoutchouc. Or, 200 parts of erythrene are liquefied by cooling with a mixture of ether and solid or liquid carbon dioxide, and the liquid is then heated in an autoclave for four days at from 90 deg. to 100 deg. C.; unchanged erythrene is now removed, and the residue is heated for some time *in vacuo* on a water-bath which is finally raised to boiling. A liquid distills over while the new product remains.

Action of an Acid Product of Combustion on Copper Smokestacks

BY GEN. W. A. JONES, U. S. A.

The screw-pile lighthouses in the United States are off-shore structures standing in a considerable depth of water. The foundation is a braced polygonal system of forged iron piles, which carry upon their lower ends broad screw-shaped disks which spread the bearing surfaces of the piles over a considerable area, sufficient to carry the weights imposed upon them. A horizontal platform is built on top, and upon this is erected a wooden keeper's dwelling with lantern and fog signal accessories suitably disposed upon it. There is, of necessity, a considerable vibration to such structures in high winds, and this is sufficient to preclude the use of anything other than metal pipes in carrying off the products of combustion created in the service of the house. These pipes are made of copper, to minimize the corrosion in the moist sea air, and each joint overlaps the one below it. The water supply for the keepers of these houses is rain water led from the roofs into cisterns or large tanks.

Shortly after taking charge of the lighthouses in Chesapeake Bay in 1897, I noticed a peculiar blue substance spattered all around on the roof in the vicinity of the smokestacks of some of the older of these houses. An examination showed that it was copper sulphate which, running off with the rainwater in the cisterns, was making the keepers very anemic and sick. It was difficult to conceive how it could get there until closer observation of the copper stacks showed that most of it came out of the tops of those stacks in great drops of solution which the wind scattered about on the roof and the balance was found trickling down the sides of the pipes, coming from within to the outside through the joints between the sections. Afterward it was found that the fuel used was hard coal containing sulphur. In the products of combustion of this coal there is a great deal of aqueous vapor, and the sulphur goes off as sulphurous acid gas, which is freely soluble in water. It was now quite evident that in some way or other a solution of sulphur gas in water was getting in contact with the interior of the copper smokestacks and there making copper sulphate by corroding them. A study of the solubility of various metals in sulphurous acid revealed the fact that all of the metals which were available for the construction or coating of such pipes were soluble in this acid. The use of brick or terracotta smokestacks was precluded by the considerable oscillations of the structures in high winds.

The next thing in order was an analytical study of how the acid got in contact with the copper so freely. This resulted in the following inference, which proved correct: The hot gases charged with acid were forced upward through a cylindrical opening which had a covering of metal. This metal was an excellent conductor of heat. When the fire below was high the hot gases kept the metal hot, but as the fire slowly slackened there came a time in cold weather when the escape of heat by convection through the copper into the air outside was so much more rapid than could be replaced by the ascending current that a thin layer in contact with the inside of the pipe was reduced in temperature below its dew point, and water condensed on the surface of the pipe. This water freely absorbed sulphurous acid gas from the ascending column of gases, and this acidulated water in turn attacked the copper, creating a solution of copper sulphate. But how could this solution be drawn upward and thrown out of the top of the pipe in sufficient quantity to bespatter the roof all around it? It also trickled downward, escaping to the outside through the loose joints in the pipe and eating up these pipes with corrosion on the inside at the first bend. It may be inferred that when the fires are first started up after having been extinguished, they go off with a great blaze and powerful rush of hot gases which mechanically carry the copper solution upward and out at the top.

UNITED STATES GOVERNMENT LIGHTHOUSE IN CHESAPEAKE BAY, SHOWING THE COPPER SMOKESTACKS.

Obviously, the remedy to be applied to correct these conditions was to stop the free convection of heat from inside the pipe through the copper pipe to the air outside. By inclosing the pipes in any of the non-conductor materials used for jacketing steam pipes, sewing a canvas cover over this, and painting it, the trouble was completely corrected.

Messrs. Yarrow & Co. of Glasgow have just received an order for a high-speed motor boat for service at Buenos Ayres. The vessel will be 60 feet long by 9 feet beam; propelled by five sets of internal-combustion engines of the Yarrow-Napier design, of approximately 300 total horse-power, designed to give her a speed of 25½ knots. She will be practically similar to the "Mercury II.," built by Messrs. Yarrow for the British Admiralty. It may be remembered that his late Majesty King Edward and a royal party went for a trip in the Solent in the "Mercury II." during Cowes week, 1906.

LIFE-PRESERVING GARMENT FOR AVIATORS

A ROBE THAT OPENS, INSTANTLY, INTO A PARACHUTE

A great deal of attention is being directed these days to the question of guarding aviators against accident. In last week's issue of the Scientific American, we illustrated one method of doing this, which consisted in providing the aviator with a loose garment which, in case of a fall, could be spread out to serve as a parachute, and thus check the rapidity of his descent. Another form of garment having this same end in view is illustrated herewith. The garment has the appearance of a loose-fitting robe, which is secured to the waist and limbs of the aviator and is buttoned in front, so that under normal conditions it will not be puffed out by the wind. The aviator's arms pass through short sleeves, which give him sufficient freedom to operate the steering gear. The garment is buttoned together, not with ordinary buttons, but with snap fasteners, so that by moving the arms out quickly, these fasteners come open, permitting the garment to fill with air, and assume the shape of a parachute. A framework supported on the back of the aviator assists in maintaining the parachute form.

As explained in last week's issue, a fall from a moderate height is of more frequent occurrence than one from high altitudes. In case of accident the aviator is able to recover the balance of his machine when high in the air, whereas if a sudden gust should strike him when near the ground, he would have no time to save himself. An effective parachute, therefore, should be one that will open quickly and buoy the aviator almost instantly. Such a result is claimed for the dress shown in the accompanying engravings. One of the views shows the aviator jumping from the top of the wall. The camera has caught him as he has fallen but a few feet, and yet the parachute garment has opened sufficiently to buoy him up.

The parachute buttoned up. Jumping from a wall. Framework at the rear.

LIFE-PRESERVING GARMENT FOR AVIATORS.

A new solvent for rubber is the subject of a recent German patent. The ordinary solvents are inflammable or have a high specific gravity, and moreover, these solvents do not give a veritable solution. It is now found that bichloride of ethylene is an excellent solvent and is to be preferred to chloroform or ether. The new solvent has the form of a clear liquid, boiling at 55 deg. C. (131 deg. F.). It is more volatile than the other usual liquids for dissolving rubber, and is also non-inflammable, which is a valuable property. It has a low specific gravity and does not give off explosive vapors.

PHOTOGRAPHING THE FLIGHT OF PROJECTILES.

BY DR. ALFRED GRADENWITZ.

The improvements suggested by the late Prof. Marey of Paris have made of the cinematograph not only an effective apparatus for popular exhibition purposes, but one of the most useful instruments in scientific investigation. By decomposing even the swiftest movements into their various phases, it in fact allows the very mechanism of motion to be studied. Among the most remarkable achievements in this connection should be mentioned the photographing of the flight of insects and the production of animated X-ray pictures, both of which have been done by the scientific staff of the Marey Institute.

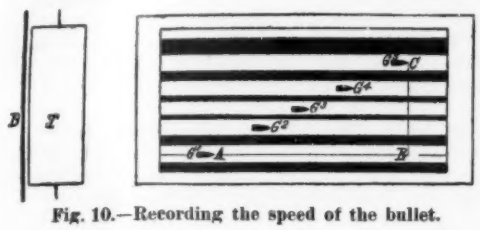


Fig. 10.—Recording the speed of the bullet.

It will be remembered that Lucien Bull, in photographing the flight of insects, used electric sparks for obtaining an extremely rapid succession of individual views. Dr. Cranz, professor at the Berlin Military Academy, independently of the French experimenter, has evolved another spark method of cinematography which is even more effective, allowing as it does a series of 500 consecutive pictures to be recorded within 1/10 of a second, the times of exposure varying, according to the sharpness of pictures, between 1/1,000,000 and 1/10,000,000 of a second.

As this method is mainly intended for investigating the mechanism of the flight of projectiles, it until quite recently was kept secret for military reasons. Through the courtesy of its inventor, we are now enabled to place before our readers a detailed description of the arrangement used by him. Needless to say, the same method can be used advantageously in studying any kind of rapid motion.

The system is based on a combination of the principle of wireless telegraphy and the Mach principle.

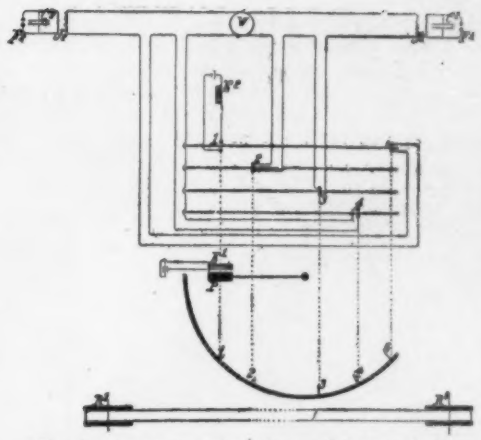


Fig. 1.—Arrangement of the pendulum switch.

(*Continued on page 427.*)

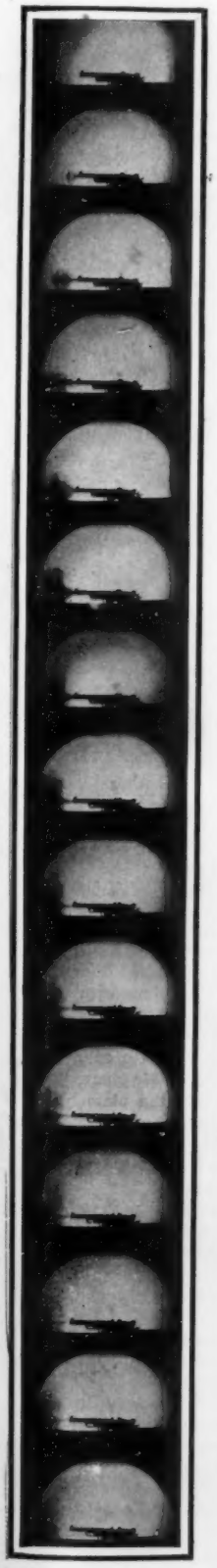


Fig. 2.—Action of self-loading pistol.

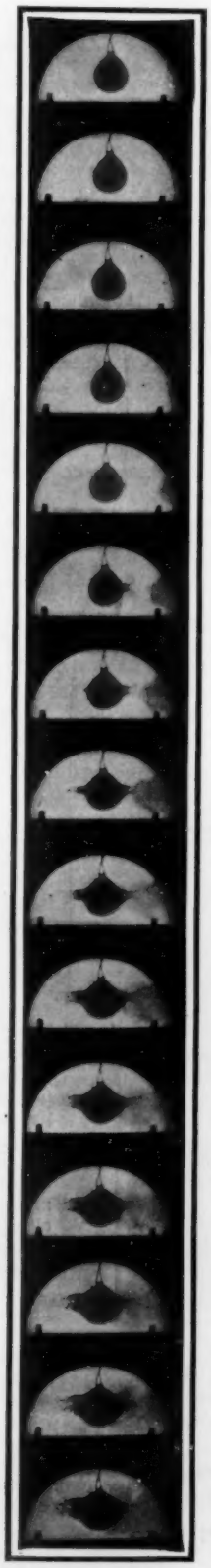


Fig. 3.—Bullet piercing ball of clay.

Fig. 6.—View at the very instant of explosion.

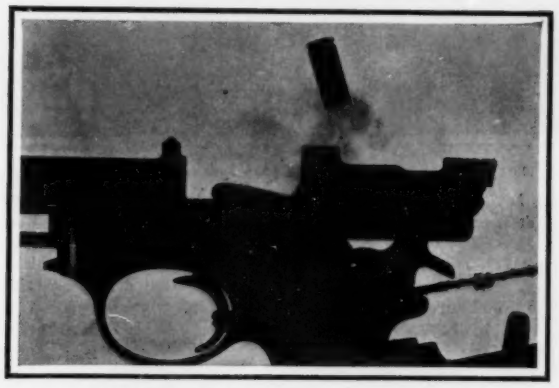


Fig. 7.—Discharge showing unconsumed grains of powder.

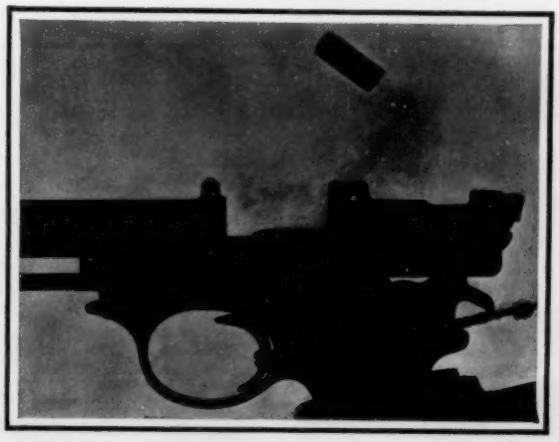


Fig. 8.—Another discharge showing unconsumed powder.

Fig. 9.—Projectile issuing from the mouth of the barrel.

Fig. 4.—Effect on water-filled rubber ball.

Fig. 5.—Waves of pressure shown by jets.

LAUNCHING AN AEROPLANE FROM A WARSHIP

ELY'S FLIGHT FROM THE CRUISER "BIRMINGHAM"

Spurred on by the two abortive attempts recently made to launch an aeroplane from the deck of a Hamburg-American liner when fifty miles out from Sandy Hook, for the purpose of carrying mail, our naval authorities quickly took up this idea, and had a platform built on the forward deck of the scout cruiser "Birmingham." The services of Eugene Ely, with his Curtiss biplane, were secured for the making of this first attempt to fly from the deck of a naval vessel to a designated spot ashore, which in this instance was the navy yard at Norfolk, some 30 miles from where the cruiser was anchored.

After the failure of aviator Mars to fly ashore from the deck of the liner "Pennsylvania" on the 8th instant, owing to the gale which was blowing, his brother aviator, Ely, the following day, assembled and tested his biplane at the Jamestown, Va., race track. On Monday morning, November 10th, his machine was transferred by a government tug to the navy yard, and placed aboard the "Birmingham." Escorted by two torpedo-boat destroyers and accompanied by two other of these craft (the "Bailey" and "Stringham" from Annapolis, carrying Assistant Secretary Winthrop and other naval officials) the "Birmingham" left Norfolk at 11:30 A. M., and steamed 30 miles down Chesapeake Bay.

At 1 P. M. a report was received from Cape Henry that there was fog over the lower bay, and that light rain was falling. It was feared that Ely would be obliged to postpone his flight. An hour later, however, a wireless message from the cruiser told of the preparation of the machine, and at 2:48 P. M. another message told of the engine of the biplane making so much noise that it was impossible to send messages. A few minutes later came the words "Ely off," and shortly thereafter another message told of his landing on Willoughby Spit, a point of land about 2½ miles distant from the cruiser.

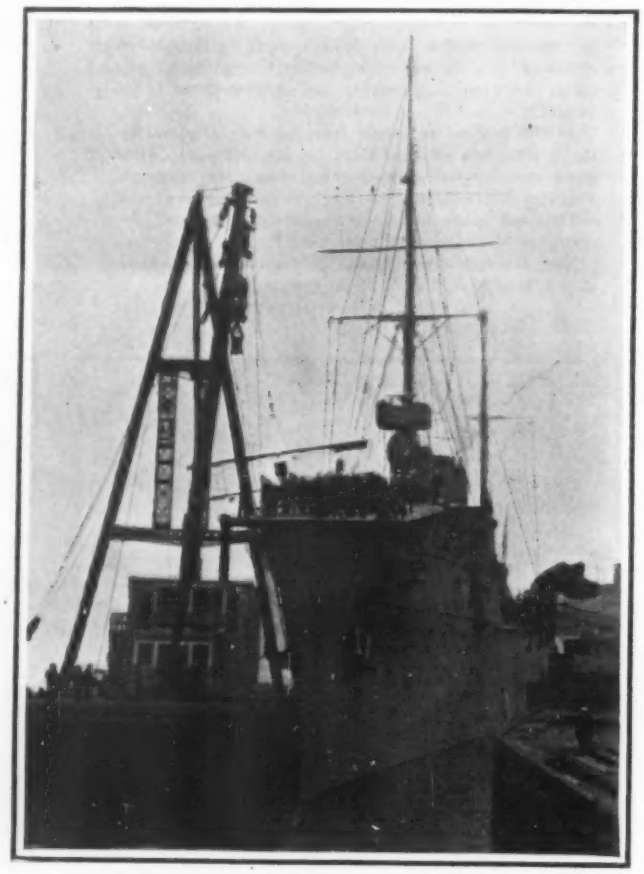
As our frontispiece shows, a platform was erected upon the bow of the "Birmingham" for the carrying out of this experiment. This platform was 25 feet wide by 85 feet long. It had a downward slope, and projected slightly beyond the bow of the cruiser.

Despite squalls of wind and rain, Ely decided to attempt a flight. Watching a favorable opportunity, between squalls, he had his engine started, and ran his machine down the incline at a rapid rate. As it left the platform it settled rapidly till it struck the water with a splash, which the spectators supposed marked the termination of the flight. Instead, however, the machine rose again and continued on its way. It reached a height of 150 feet or more, and traveled straight for the nearest land, where it descended without a mishap. Mr. Ely attributed his downward plunge to a faulty movement of his control wheel. When the machine struck the water, the propeller was damaged, and the spray flew up in his face, and so clouded his goggles that it was with the greatest difficulty that he was able to see his way to shore. After landing on the beach near the Hampton Roads Yacht Club, he found everything except the propeller in good shape, and could have flown back to the cruiser had he deemed this expedient.

The significant point in this first flight from a vessel is the fact that the aeroplane started under its own power from the cruiser at rest. With but an 85-foot run and a 30-foot drop, and considering the bad weather conditions, this was an excellent performance. A speedy war vessel offers the great advantage that it can be run against the wind fast enough to allow an aeroplane to rise from its deck without any run whatever. In alighting, too, the aeroplane could simply hover above the vessel in motion and drop gently to her deck. In the place of cumbersome platforms, all that would be needed for starting would be troughs for the wheels to run in, which could be readily stowed away when not in use. However, wheels on a marine aeroplane are an anomaly not to be endured. Such a machine should be equipped with hydroplane floats (like the successful hydro-aeroplane of M. Fabre), which would make it possible to alight upon and start from the water. A special car and starting rail like that originally used by the Wright brothers could be employed for launching the aeroplane from the vessel.

So far as we are aware, Ely's flight is the first to be made from a vessel. The French naval authorities fitted up a torpedo boat for this purpose a short time ago, however, and it may be that a similar test in France has been held secretly. In the present instance Capt. W. I. Chambers, Lieut. N. H. Wright, and Naval Constructor William McIntree were appointed to witness the flight and to render a report to the Navy Department. This experiment was arranged, doubtless, with a view to demonstrating, or rather suggesting, the usefulness of the aeroplane for widening the range of vision of the naval scout. If an aeroplane can leave and return to a scout cruiser, like the "Birmingham," at will and with certainty, the radius of usefulness of such vessels will be enormously increased.

As a result of his flight, Aviator Ely received a prize of $500 from the Aerial Reserve. A similar prize has been offered for the first flight from a commercial vessel to the shore, also.



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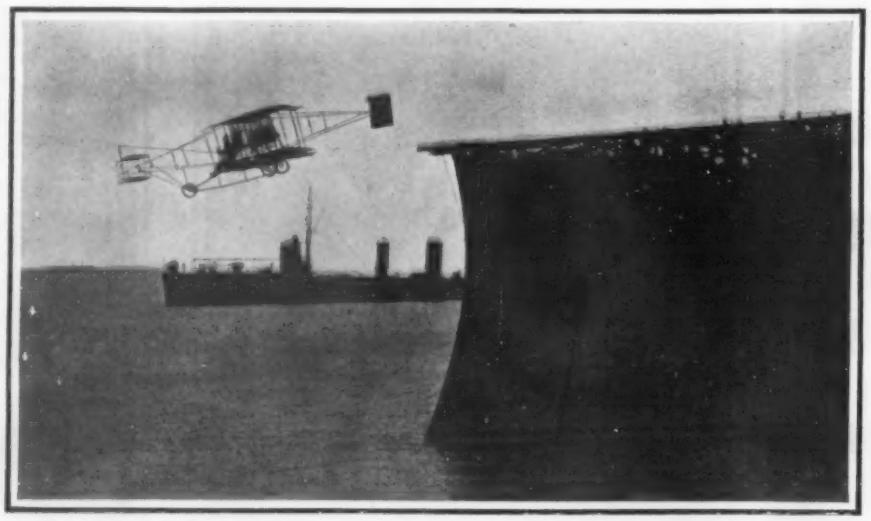
Hoisting Ely's aeroplane to the launching platform on the forward deck of the cruiser "Birmingham" at Norfolk, Va.



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Ely in his Curtiss aeroplane starting on his flight from the deck of the United States scout cruiser "Birmingham" in Hampton Roads to Willoughby Beach, 7 miles away. Photograph was made just before he hit the water.

The Making of Bank of England Notes.

About the year 1819 a great outcry was raised against the Bank of England for not adopting a style of note that could not be imitated, at the same time preventing the sacrifice of life which at that period was all too common, the punishment for forgery being death. The subject at last became so pressing that the government appointed commissioners to investigate the cause of the numerous forgeries, and whether a mode could be devised whereby the forging of bank notes might be prevented.

Previous to this investigation the directors of the bank had been endeavoring to remedy the evil, many plans having been submitted to them, all of which they were obliged to reject. At one time they were about to adopt a curious and very costly machine for printing the notes on both sides, so exactly alike as to appear one impression, when a workman came forward and showed that the same thing might be done by the simple contrivance of two plates connected by a hinge.

The bank placed before the commissioners one hundred and eighty different projects that had been recommended for their adoption, and seventy varieties of paper made at their factory by way of experiment.

The result of all this labor was the bank note of to-day. The color of the paper is peculiar, and cannot be imitated exactly by counterfeiters except at great expense. The combined thinness and strength of the paper are also unique. It is made in sheets large enough for two notes. Each note, before it is sized, weighs about eighteen grains, and if then doubled, it is strong enough to suspend a weight of thirty-six pounds. The texture of the paper is also peculiar. It has a crisp feel, invariably the same, and such that bank clerks of experience can readily detect forgeries by this test alone.

Then the wire-mark, impressed in the making by a frame, costly to make and difficult to use, is practically inimitable.

Each note has thin, rough edges, uncut, not to be produced by any mode of cutting paper that is not made expressly for the purpose. The paper for printing is damped with water in the exhausted receiver of an air pump. The ink used in the plate printing is made of Frankfort black, which is composed of the charcoals of the tendrils and husks of the German grape, ground with linseed oil. This ink has a peculiar and very deep shade of black, common black inks being tinted either with blue or brown.

The opening of the new transcontinental railway across the Andes, in the lower part of South America, will effect a reduction of from thirty-one to twenty-seven days in the mail and passenger service between Australia and London. The steamers from Australia will land at Valparaiso, and at that point connection will be made with either Montevideo or Buenos Ayres, and the route continued from those ports by regular English lines. Heretofore mail and passengers were carried by steamer from Valparaiso, around Cape Horn to Buenos Ayres or Montevideo.

Correspondence.

THE STANDARDIZATION OF FOUNDRY FLASKS.

To the Editor of the SCIENTIFIC AMERICAN:

In giving you the figures of measurement for the United States standardization of foundry flasks that you illustrated on page 378 of November 12th, I made a mistake in giving the distance across the flask from the center line to the center of the pin-holes. It should be one and one-sixteenth (1 1/16) inches greater instead of 1⅜ inches, as the former registers within about 1/1,000 of an inch with 27 millimeters. It also locates the pin-holes closer to the sides of the flask, which is desirable. All flasks should have additional lugs or ears on the right angle center lines, at both ends and sides, so match plates can be used to advantage on snap flasks and for all machine molding. MERRITT W. GRISWOLD.

Highwood, N. J.

A COMPARISON—AEROPLANE AND BIRD.

To the Editor of the SCIENTIFIC AMERICAN:

In comparing the flight of birds with that of aeroplanes in the issue of November 5th, 1910, of the SCIENTIFIC AMERICAN, on page 362, the statement is made that "the bird, even at its fastest, does not fly at a speed that equals the slowest speed of the biplane." This was undoubtedly just a thoughtless statement of the writer, but it brings out one very interesting incident that happened on one of the days of the meet. There was a sparrow hawk (*Falco sparverius*) that had its roosting place among the timbers on the southeastern corner of the grandstand. When coming to roost, he was very much disturbed, either by the band or by the flight of the aeroplanes. At one time, when Grahame-White, in his Farman biplane, was passing the grandstand, the hawk came around behind him and caught him, and passed him, within the length of the grandstand. If the aeroplane was going at the rate of 30 or 40 miles per hour, then the hawk must have been traveling at the rate of 100 miles per hour or more. In comparison, the biplane "looked as if it were standing still." On Sunday, the 23rd, when the wind was blowing a gale, and the only two machines that ventured out were wrecked, this little hawk demonstrated his vast superiority; he would dart and swing almost incredibly, and make high velocity even against the wind. The most remarkable part of the performance was the astonishing celerity with which he could check himself, and the perfection of his gage of momentum. He would stop himself and change his direction in just a few times his own length, and one of his methods of alighting was to fly full tilt at the corner and then sweep around under it, in an arc of 10 or 15 feet, alighting as accurately and smoothly as one could lay a paper upon a shelf by hand. There was none of the wing flapping, as frequently seen when a pigeon, for instance, alights. Say that he was traveling at the rate of 60 miles per hour, and that he weighed 8 ounces.

Then the energy stored up would be $\frac{Wv^2}{2g} = \frac{\frac{1}{2} \times 88^2}{2 \times 32.2}$ = about 60 foot-pounds. This would be enough to lift his weight 120 feet. Now, how does he manage to dissipate this energy in a 15-foot arc, and do it so accurately as to alight like a snowflake? The above weight is guessed at, but it must be somewhere near right. The speed of striking the arc would be over rather than under 60 miles per hour.

Watervliet, N. Y. J. ROWLAND NOWELL.

ELECTRIC BURNS.

To the Editor of the SCIENTIFIC AMERICAN:

A case has come under my notice where a lad has been very badly burned by electricity. It appears certain that the injury is due to 110 volts, 60 cycle. It would seem impossible for this voltage to cause serious burning, but no data are available as to the result of a continuous application of such voltage for any period beyond a few seconds. The details of this case are as follows: A ten-year-old lad was very badly burned from grasping a lighted incandescent lamp on a 110-volt 60-cycle circuit. He was lying in bed with his head between the rungs of the iron bed frame, the leg of which was thoroughly grounded on a steam heating pipe. The secondary circuit of the transformer was securely grounded. Also the threaded portion of the lamp stem which he grasped was exposed for a good contact with his soft fingers. Evidence is positive that the lad was for an unknown time stuck between the lamp stem and ground, which were 110 volts apart. Although very badly burned at both hand and scalp, the boy is up and about. It would seem that 110 volts could not cause burning of human flesh and bone, but I am so far unable to locate examples of injury known to have resulted from *continued application* of 110 volts alternating current. If you have any such information, I should be very much obliged to you for reference to or account of it. H. W. PRICE.

Toronto, Canada.

AVIATION TERMINOLOGY.

To the Editor of the SCIENTIFIC AMERICAN:

It has occurred to the writer that while the language of flying is still in flux, an effort should be made to provide the art with a native nomenclature of concise and pertinent terms. While all that led to successful flight by no means was done by Americans, still because the Wrights were the first actually to stay in the air upon a power lifted and driven device, the first mechanical bird may properly be classed as an American fowl. Therefore, as well as for the more practical reason of economy in speech effort, the introduction and acceptance of a foreign terminology should be resisted, and the language of flight set upon an all-English-American basis. That even from an esthetic standpoint the proposed movement is desirable, must appear to anyone who will but listen for a moment to the current pronunciations of the words *chauffeur, garage, chassis.*

In order that the subject may be opened for discussion, the following glossary is offered; in which, also, is suggested the substitution of what is believed to be better and simpler English terms for many now struggling into use.

Aeroplane	Airplane
Aileron	Independent stabilizer Stabilizer
Alighting	Grounding; to ground
Altitude	Height
Aviation	Flying
Aviation tournament	Flying meet; a fly
Aviator	Airman; flyer
Direction rudder	Director
Elevating rudder	Elevator
Epinage	Tail
Hangar	Shed
Propeller; tractor	Screw; fore-screw; aft-screw
Pylon	Mark
Volplane	Glide; to glide; to plane
That portion of a plane which is warped	The warp
The wire or cable used to control warping	Warp cord
The wire or cable used to control elevation	Height cord
The wire or cable used to control direction	Steering cord
That portion of the start which is upon the ground	The run
That portion of the start which is between the run and the height sought	The rise
Failure to rise after a run	A misup
The length and nature of a grounding may be spoken of as	A long ground, a short ground; a hard ground, an easy ground.

New York, N. Y. HENRY A. WISE WOOD.

[Comment on this letter will be found in our Editorial columns.—ED.]

AN OLD BALLOON FOUND IN CANADA.

To the Editor of the SCIENTIFIC AMERICAN:

I have been reading a good deal in your paper about the balloons that started some little time ago from St. Louis and landed at the different places you have named in your paper. The balloon that seems to have made the greatest distance landed near a lake northwest of Quebec.

About 1854 or 1855 I was working as superintendent for Messrs. Gilmore & Co., lumbermen, who were operating very largely in different parts of Canada, and on one of my trips during the winter of 1854 or 1855, when looking over their logging operations on the Gatneau River, which empties into the Ottawa River just below the city of Ottawa, the river running generally north and south, I went pretty well to the head waters of the Gatneau River, some one hundred and fifty or sixty miles.

On that trip I stayed one night in one of the company's logging camps, and the foreman showed me some pieces of a balloon and some pieces of the ropes connected therewith, and told me this story: He and one of his men were looking out a logging road some distance from the camp, and found two men following along a lake which was called by the Indians in that country Lake de Jaboul, and the camp this foreman was in charge of was on the creek leading from Lake de Jaboul into the Gatneau River, and was called Creek de Jaboul. As I remember, the name of the aeronaut who sailed the balloon was Le Fontaine. They had been in the woods along that lake for a couple of days before the foreman and his man found them, and were out of provisions and pretty well used up. The foreman took them to the logging camp, where they were fed and cared for; and the next day they said they thought they could retrace their steps to where the balloon had landed them, and succeeded in finding it, and with the help of several of the men working in the camp, brought quite a portion of the balloon to the camp, and the foreman sent the two men down to Ottawa with one of the teams that hauled supplies from Ottawa to the camp. They gave me some pieces of the balloon and some pieces of the ropes, which I took down to Ottawa with me on my return there, but I don't know now what became of them. The men said they started from St. Louis in the balloon.

I have been wondering since reading the accounts of these balloons that started from St. Louis, whether there was any record of that balloon that started from St. Louis and landed in the woods north of Ottawa city, some one hundred and fifty or sixty miles from the city of Ottawa. If you have any means of throwing any light on this, it would be interesting to me, and I shall feel very much obliged to you for such information as you can give me. I have been a subscriber and reader of your valuable paper for many years, and possibly you may be able to give some account of this in your paper. It may be that balloon did not start from St. Louis, but that was the report of the two men above referred to, and I very much hope you will be able to give me some light on the subject. O. H. INGRAM.

Eau Claire, Wis.

The Tragic End of Johnstone.

Ralph Johnstone was almost instantly killed by a drop of 800 feet in his runaway biplane at Overland Park, Denver, on November 17th last.

From the time he lost control of the machine until it struck the earth it turned three complete somersaults. The cause of the accident is unknown.

Johnstone had been doing magnificent work in the air for two days, and before the accident had soared away from the park and taken a turn over Fort Logan, several miles distant, while Hoxsey and Brookins were maneuvering over the park.

When the crowd saw him returning at an altitude of about 800 feet there was a great cheer. As he gracefully dipped his machine in response he was again cheered, and he began making a spiral descent to the starting ground in the park. Then it was noticed that his machine pitched several times. Suddenly the aeroplane darted toward the ground, and after turning three somersaults struck the earth with terrific force.

During the descent Johnstone could be seen clutching the levers about his seat, while the frightened spectators hoped that by some chance he could right his machine and save himself.

When the aeroplane struck, the spectators rushed from the grand stand and paddock and literally crushed one another trying to learn the fate of Johnstone.

It is said by some eyewitnesses that Johnstone tried hard to regain control and that he even left his seat in the effort to right his somersaulting machine.

The Current Supplement.

The current SUPPLEMENT, No. 1821, contains a remarkable number of meritorious articles. Mr. Grover Cleveland Loening continues his paper on "The Theory and Practice of Aviation." In the present instalment, he discusses the resistance of the air and the pressure on normal planes.—Cornelius D. Ehret gives a brief review of wireless telegraphy and telephony.—The review of the Paris salon is concluded.—"In the Heart of Africa" is the title of an article by Mary Cynthia Dickerson, in which are described the experiences of Messrs. Herbert Lang and James Chapin in the Congo region.—Mr. W. F. Denning tells us something about the planet Saturn.—Warren O. Rogers writes on modern rotary steam engines.—One of the most interesting problems of the wireless electrical control of machinery is that of the steering of torpedoes. The subject is ably handled in an article entitled "The Gabet Torpedo."

A $15,000 Prize for Aeroplanes.

Mr. Edwin Gould has offered, through the columns of the SCIENTIFIC AMERICAN, the sum of $15,000, which is to be awarded for the construction of a heavier-than-air flying machine, equipped with more than one motor and propeller.

The conditions governing Mr. Gould's offer were published in the SCIENTIFIC AMERICAN, issue of November 19th.

The concrete pipe line just completed for the Ontario Power Company is declared to be unique in its engineering features among the great pipe lines of the continent. It is, in fact, the only one of its kind and size in the world. In diameter it is 18 feet, and a mile and a quarter in length. It took but five months to complete it. Resting on a solid foundation of concrete, it traverses a section of almost every known variety of soil. Rock, gravel, loam, and quicksand were encountered. The number of bags of cement used was 247,642, besides 2,350 tons of steel. Its walls are fully 18 inches in thickness. The big pipe could easily be used as an underground railway tube for an ordinary trolley or passenger train.

THE YEAR'S PROGRESS ON THE PANAMA CANAL

RAPID CONSTRUCTION GIVES PROMISE OF AN EARLY OPENING

Gatun spillway looking north. The concrete structures placed radially across the channel mark the position of the spillway dam over which the surplus flood waters in the lake will discharge through regulating gates.

The annual report of the Isthmian Canal Commission, as made by Col. George W. Goethals, Chairman and Chief Engineer, reveals an unexpectedly rapid rate of progress along the whole line of the Panama Canal.

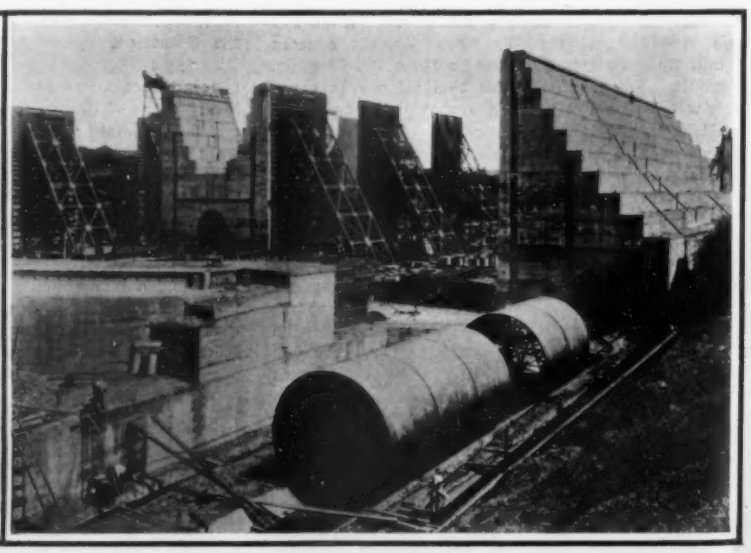
The controlling factor in this great work, as regards the date of its completion, is the double flight of locks in three lifts at Gatun; and here the rate of construction, both in the excavating, concrete work, and the preparation of the huge steel gates for the locks, and the culverts and operating valves for filling and emptying the locks, has been most satisfactory. During the year, the excavation in the lock chambers has amounted to nearly four million cubic yards in the dry, and about half a million cubic yards in the wet, together with 646,520 cubic yards of excavation in auxiliary work. The excavation in the upper and the middle locks was completed during the past year, and that for the lower locks was all done with the exception of 375,000 cubic yards. The average cost, including plant charges and division expenses, was $0.6751 per cubic yard. The total amount of concrete to be placed in the Gatun locks, including the approach and wing walls, is estimated at 2,046,100 cubic yards; and of this total, 513,803 cubic yards is in place. The average cost per yard, in place, of concrete for the year was $7.355, including plant charges and division expenses.

During the fiscal year such general and detail drawings of the lock gates as were necessary to advertise for all the gates required, were completed, and the contract was secured by the McClintic-Marshall Construction Company for the whole of the work for $5,374,474, the prices being 3.785 cents per pound for structural steel erected, and 2.62 cents per pound for structural steel not erected. This huge work, which calls for the erection complete of 46 gates, including 92 leaves, was to have been completed January 1st, 1914, according to the advertisement. The successful bidders bind themselves to complete the work by June 1st, 1913. By this it will be seen that the prospects of opening the canal far in advance of the original estimate for January 1st, 1915, are very promising.

At the close of the fiscal year, the rock fills which form the north and south toes of the portion of the Gatun dam east of Spillway Hill, had reached an elevation of 65 feet above mean tide, and the hydraulic fill forming the body of the dam between the toes had reached an elevation of 51 feet. West of Spillway Hill, the north toe had been carried to an elevation of +40, and the south toe to an elevation of +35. The final elevation along the crest of the completed dam will be +120. The total amount of material placed in the dam during the fiscal year by dry fill was 2,577,204 cubic yards, and by hydraulic fill about 3,000,000 cubic yards. The average cost for the dry fill, including all charges, was 28.19 cents per cubic yard, and for the wet fill, 32.54 cents.

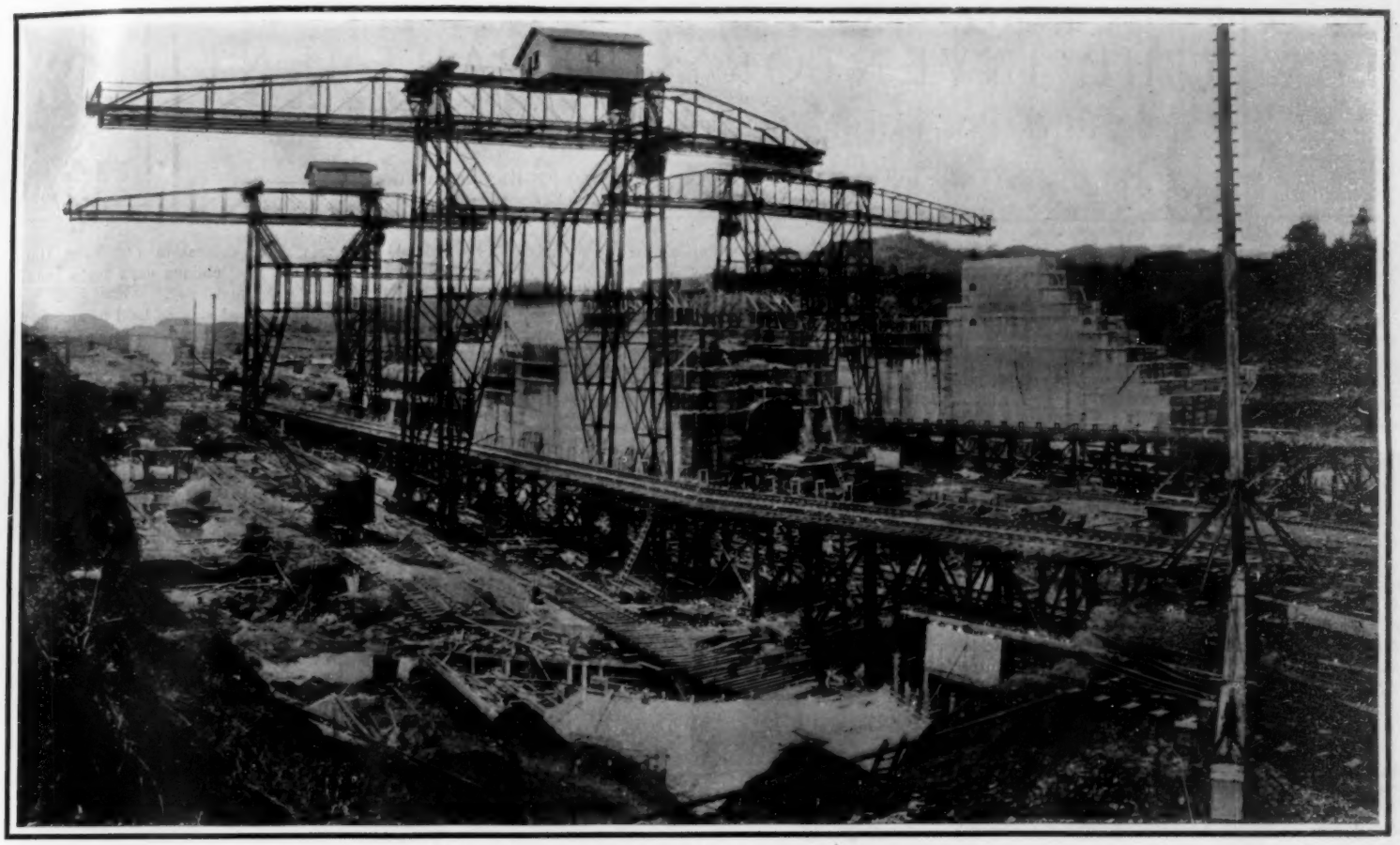
The general design for the spillway dam at Gatun has been completed. In plan it is a semi-circular arc. It is divided into fourteen bays, 45 feet wide, by thirteen piers and two abutments, closed by means of Stoney gates operating on trains of live rollers moving on castings set in the piers. With the lake at +87, one bay, with the gates fully opened, will discharge 11,000 cubic foot-seconds, and all fourteen fully opened will discharge about 154,000 cubic foot-seconds, or a greater amount than the maximum known discharge of the Chagres River continued during a period of thirty-three hours, which is 137,500 cubic foot-seconds at Gatun. Since the coping and top of the gates at upper Gatun and Pedro Miguel locks have been placed at +92, it would require a rise of five feet in the Gatun Lake to do material damage; and as it would take the maximum continued dis-

Gatun Lake spillway looking down stream with the River Chagres flowing through.



Construction of the concrete side and center walls of the upper locks at Gatun.

THE YEAR'S WORK ON THE PANAMA CANAL.



Construction of the Pedro Miguel locks near the Pacific end of the canal.

charge of 137,500 cubic foot-seconds nine hours and twenty minutes to raise the level of the lake one foot, were no gates of the spillway opened during this time, ample provision has been made to take care of the floods that may occur, even should there be any negligence or delay in the operation.

Investigation of the expenditure of water from Gatun Lake has been carried on during the past year. The results indicate that during ordinary years there will be a considerable surplus of water, even in the dry season, and that the water supply of the worst known dry season for the last nineteen years, namely, that of 1908, would be sufficient to maintain through the canal an average daily number of ship passages three or four times as great as the average number now passing the Suez Canal. This holds true, even after making reasonable deductions for evaporation, leakage, power supply, and lockages. By April 25th of this year, the side walls, floor, and curtain walls of the spillway were completed, and the foundation of the dam was sufficiently advanced to warrant turning the Chagres River through the spillway.

During the year good progress was made on the channel between Gatun locks and the Atlantic Ocean. The deepest part of the cut through the land had reached a depth of 42 feet below sea level when work was suspended. The dredges at work on the portion of the canal from the shore line to deep water removed four and a half million cubic yards of earth, and 400,000 cubic yards of rock. The west breakwater for the protection of shipping entering from the Atlantic is to be extended out to the 44-foot depth at sea.

The total amount removed from the Chagres section, extending from Gatun to the Culebra cut, was 9,497,673 yards, leaving still to be excavated about 3,415,944 cubic yards. Work in this section has consisted largely of removing the higher points of land which project above the 45-foot channel, which will extend through the Gatun Lake from Gatun to the entrance of the great cut.

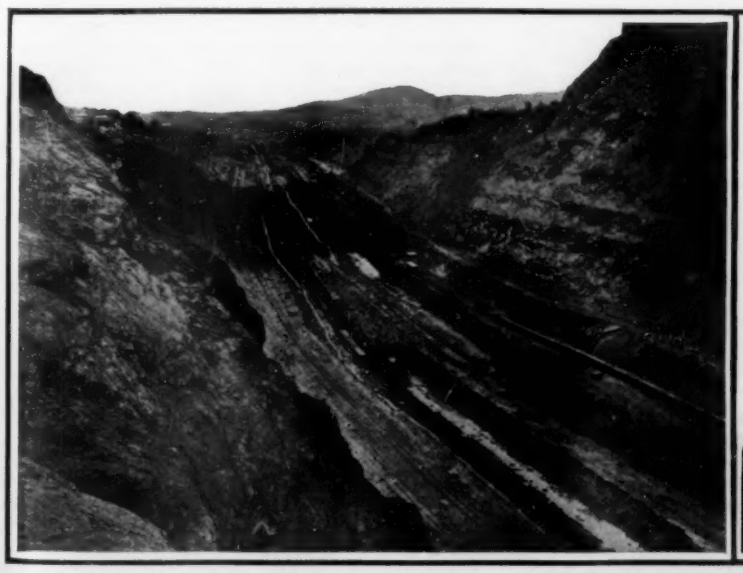
From the Culebra cut there has been removed during the fiscal year about 15,000,000 cubic yards of material, leaving about 35,000,000 cubic yards to be removed to complete this section of the canal. As the excavation progressed, slides developed, due to the slippery or fractured nature of the underlying material. Since the estimate of 1908, an increase in quantities has been made of nearly one million cubic yards, due to widening the canal north of Pedro Miguel lock to form a basin for shipping and an addition of nearly five and a half million cubic yards has been made for removing slides and breaks in the sides of the cut. These slides are annoying and costly, but entirely unavoidable. They will not in any way affect the time of completion or the final stability of this portion of the work.

Good progress has been made in excavating the lock sites and approaches at Pedro Miguel and Miraflores. The special plan designed for this work has been modified and improved and there is every indication that the excavation and concreting, and erection of the gates and mechanical plant, will keep pace with the work elsewhere throughout the canal.

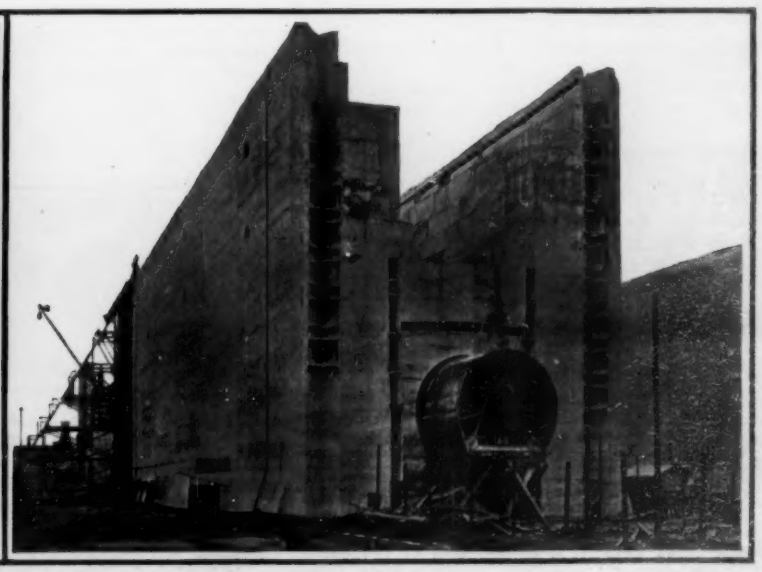
At the Pacific entrance, a breakwater is being built from Balboa to Naos Island, with the object of cutting off silt-bearing currents from the excavated channel leading to deep water in the Pacific, thereby reducing the cost of maintenance and making navigation of the channel easier by protecting vessels from the existing cross currents. This breakwater is being constructed by driving a railroad trestle and dumping therefrom the rock excavated from the canal. At the end of the fiscal year the total length of the trestle from shore was 2.4 miles. At that time the end of the trestle was within 4,900 feet of Naos Island, and the rock filling extended to within 400 feet of the end of the trestle.

In addition to the construction work on the canal proper, a large amount of incidental work has been completed, such as the construction and improvement of the mechanical engineering shops, filling in and general sanitation of the cities of Panama and Colon,

(*Concluded on page 428.*)



Present condition of the great Culebra cut through the Divide.



The monolithic mass of concrete which forms the dividing wall between the two sets of locks, Gatun.

THE YEAR'S WORK ON THE PANAMA CANAL.

THE INVENTOR'S DEPARTMENT

SIMPLE PATENT LAW; PATENT OFFICE NEWS; INVENTIONS NEW AND INTERESTING

The Editor will pay for short articles available for this department

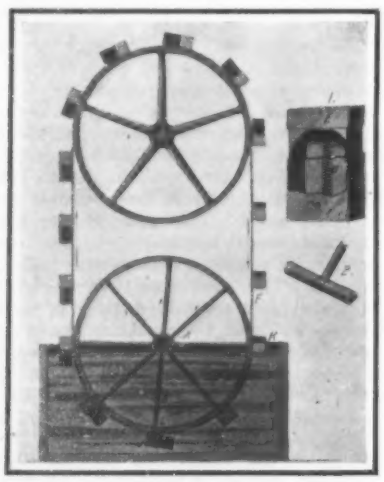
THE PROBLEM IN PERPETUAL MOTION.

BY DENNIS M'NEILL.

The accompanying drawing shows two wheels, the lower of which is immersed in water to nearly the central axis *A*, which axis, as shown in Fig. 2, is hollow and has but one opening to the wheel, which is placed at the bottom of the shaft. The lower wheel is bored radially from the circumference to the axis around which it revolves, designated *B* and *X X*, etc. These several holes have no outlet through the shaft until they reach the position shown in *B*. The shaft is fixed, and these several holes bring the opening to conjunction with the hole in the shaft as they successively come to *B*'s position from the turning of the wheel.

Fig. 1 shows the telescoping weigh boxes, consisting of a light strong section fastened to the conveyor *F*, a spring *D*, the strength of which is slightly greater than the pressure of the water at the point *J* in the main diagram; a weighted bottom *E*, which is slightly heavier than the strength of the spring *D;* and an opening marked *C*, properly gasketed to make it air and water tight when engaging the face of the wheels.

On the right-hand side of the wheels all the boxes have the spring *D* depressed, and occupy their smallest space. When the box comes to the point marked *K* and enters the water, the gasket *C* has covered the radial opening in the lower wheel, and the strength of the spring has the tendency to expand the telescope, but fails to do so at that side of the wheel at any point until the box reaches the position *L*, when the hole



PUZZLING PERPETUAL MOTION PROBLEM.

through the radius of the wheel comes coincident with the opening in the rigid axle, and allows the force of the spring to draw air through the axle into the telescope. The latter expands to its full length, and from the displacement of the water becomes lighter than the water in which it is immersed, and has a corresponding tendency to revolve the wheel in the direction of the arrow. At the top wheel the confined air in the boxes keeps them from telescoping from the action of the weighted bottom *E*, shown in Fig. 1, until the air-tight gasket has left the face of the wheel, and likewise at any point on the bottom wheel from *J* to *K* the vacuum will refuse to allow the spring *D* to expand the box until the perpendicular hole in the lower wheel passes the opening in the bottom of the fixed axle and allows the ingress of air into the interior of the box at the position on the wheel marked *J*.

To illustrate, suppose the weights weigh four pounds each, one-half pound for the section fastened to the conveyor, and the weighted bottom *E*, shown in Fig. 1, weighs three and one-half pounds. When immersed at *K*, suppose the downward weight drops to one pound in the water displaced by the closed box, and expands to displace three pounds of water, making the box weigh after passing the point at *J* minus two pounds. Now we have to lift the weight of the bottom from the point of its expansion to the closed position, but we have a lifting force of two pounds in the submerged box acting through a much longer arc to produce this force. Why doesn't the machine run?

[The Editor invites answers to this problem. The best solutions will be published in the next issue of the Inventor's Department.]

NEW KINDS OF EYE-GLASSES.

A German inventor has devised what he calls "telescope eye-glasses." They are intended for the use of short-sighted persons, by the very simple means of enlarging the image on the retina. They are especially designed for that class of near-sighted people who cannot wear the ordinary "simply corrected" glasses. The monocle combination (Fig. 1) consists of two parts united in a single metal frame—a front objective lens or collector, and a second, nearer the eye, to disperse the rays at the proper angle to make the correction for the degree of myopy in question.

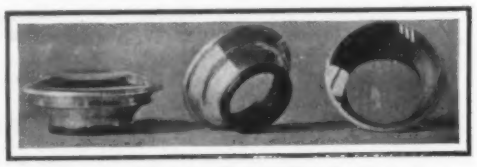


Fig. 1.—MONOCLE COMBINATION OF TELESCOPE EYE-GLASSES.

Fig. 2.—SPECTACLE COMBINATION OF TELESCOPE LENSES.

Fig. 3.—HOW THE TELESCOPE GLASSES APPEAR IN USE.

When properly prescribed and made, the two lenses have such relation to each other that there is no distortion, astigmatism or colored border to the image obtained. Although the frame is of "duraluminium," the weight of the combination ranges from 13 grammes for a glass of —18 diopters to 20 grammes for one of —10. In order to avoid annoying reflections, the tube is roughened and blackened internally.

According to Prof. Hertel of the eye clinic of Strasburg University, it is best to use such of only weak

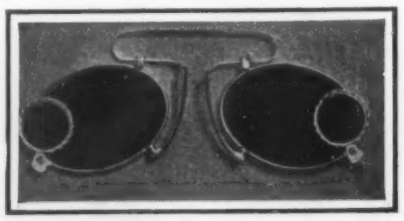


Fig. 4.—POLICE EYE-GLASSES THAT ENABLE A MAN TO "LOOK BACKWARD."

magnification, so as to enlarge the image on the retina about 30 per cent; that is, in the same degree as by operative correction. Zeiss of Jena has succeeded in making full correction with telescope spectacles of this kind for a large field of vision (averaging $2w = 43$ deg.). They are now regularly made from 10 to 20 diopters axiosymmetrical and can be made astigmatic so as to give clear vision in every direction.

Higher degrees of magnification (1.5 to 2 times) have been tried, but give oblique rays for a smaller field only ($2w = 30$ deg. and less).

Two such "combinations" may be held in a spectacle frame, as shown in Fig. 2, in which besides the ordinary central bridge there are two side clamps for the nose, that help distribute the weight, which amounts to 35 grammes for a pair of such spectacles of —16 diopters.

Another German has invented what he calls "police eye-glasses." On the side next the face they have tiny concave mirrors which may be extended sidewise or be folded back so as not to show. They give the wearer, if he has normal sight, an image of what is going on almost directly behind him. They are proposed for the German secret police; whether adopted or not is not to be ascertained from head-quarters.

ERASING BY ELECTRICITY.

BY M. M. HUNTING.

Every draftsman knows that changes and corrections of errors upon tracings are not easily made without danger of injury to the cloth. The work of

AN ERASER DRIVEN BY AN ELECTRIC MOTOR.

erasing must be done with a light quick stroke, and most men have not the time or patience to do this.

The device shown in the photograph is especially designed for this work. It consists of a circular eraser connected through a flexible shaft with an electric motor, and is rapidly revolved thereby.

The operator can apply the eraser with any pressure that may be required. A small rubber roll bears upon the eraser as it revolves, removing the superfluous ink. The pressure of this roll is adjustable. The eraser is attached by means of a winged nut so that it may be renewed. Usually one outfit is sufficient for a large drafting room, as it can be set up permanently in one place and the work carried to it.

NON-EXPLOSIVE OIL CAN.

It is a well-known principle, and one commonly used in miners' lamps, that a flame cannot pass through wire gauze or netting to ignite gas on the other side. This principle has been adopted for the use of oil cans in which highly inflammable and easily volatilized liquids are carried. In the spout

NON-EXPLOSIVE OIL CAN.

of the can is fitted a wire screen, and above this is a disk valve that closes by gravity. Normally, the valve cuts off the contents of the can from contact with the outside atmosphere. When the can is picked up, the liquid flows freely through the screen and through the valve. Not only does the screen prevent a flame from entering the can and igniting its contents, but it also serves to strain the liquid in the can.

RESULTS OF THE INVENTORS' CONTEST

THREE LETTERS WHICH RECEIVED PRIZES IN THE SCIENTIFIC AMERICAN COMPETITION

Some months ago the Editor of the Scientific American offered $100 in prizes, to be awarded to inventors who submitted the best articles or letters describing the manner in which they conceived and commercially developed their inventions. The first prize was to be $50, the second $35, and the third $15.

The manuscripts which we received gave us no little difficulty in arriving at a decision. All of them contained matter not only of interest from a literary point of view, but of great commercial value from the inventor's point of view. It was finally decided that the best letter was that of Mr. C. Francis Jenkins, of Washington, D. C., to whom the prize of $50 was awarded; the second best letter was that of Mr. L. A. McNeil, of Maywood Ill., who received the prize of $35; and the third best Mr. D. M. Chamberland, of Minneapolis, Minn., who received the prize of $15. These three prize letters are published herewith, in the hope that they will serve to guide the inventor-friends of the Scientific American by showing them how other inventors succeeded. In the next Inventor's Department the Editor will publish letters which, although they did not receive prizes, are nevertheless worthy of careful consideration for the suggestions that they contain.

FIRST PRIZE ARTICLE.

The Struggle of the Bottle.

BY "DIOXADE" (C. FRANCIS JENKINS, WASHINGTON, D. C.)

To be successful, an invention must be profitable. To be profitable, it must fill a real, often a public want. The want is frequently something-better-for-something-old.

So, in casting about for this "something," the want of a clean container to take the place of the unsanitary glass milk-bottle was chosen, a container to be used but once and thrown away, and this is its story.

To produce a substitute for the glass milk-bottle, acceptable alike to manufacturer and consumer, three things seemed essential: (1) the "bottle" must be absolutely clean and sterile, inviting in appearance, and not get soft because of the liquid content; (2) it must be so inexpensive that the milkman can use it at less cost or, at any rate, no greater cost, than glass; and (3) it must be easily and profitably manufactured, and, so far as possible, with machinery obtainable in open market; for capital is shy, often in proportion to the number of untried machines which must be invented and perfected for the production of the article.

After prolonged experimentation, the container selected as most nearly meeting these conditions was a simple, cylindrical paper tube, spirally wound, and having an inverted flanged bottom, the whole then being momentarily submerged in hot paraffine. The paraffine not only rendered the container waterproof, but served as an adhesive to fix the bottom firmly in place, no glue being permissible. The top was also a flanged closure, frictionally held in, and having tabs for readily removing it. (Patent No. 838,416.)

The article was good, but the inventor was poor. So, obviously, it was necessary to seek financial assistance, and the following plan was adopted:

A few men, most of them conspicuously successful in their own lines of business, were offered exclusive manufacturing rights for a limited territory, and without royalties, the only stipulation being that the inventor should have the privilege of visiting the plant at reasonable hours, alone or with others to whom he might wish to exhibit it. This agreement concluded, the inventor assisted in every possible way to find available machinery, inventing only such machines as could not be otherwise obtained. This not only engendered confidence, but made the money go farther, and produced quicker results.

Eventually the plant was ready and started. As usual, the new machines developed troubles, and, although these were ultimately eliminated, there were those who got "cold feet." These were wisely bought up and kicked out. But at last the plant was turning out a salable product, and money began to come in to reward the confidence of those remaining faithful. The new article seemed to attract merited attention and favorable comment, and to make a place for itself as an article of public utility.

The organization of a parent company of modest capitalization was now effected, to take over the patent, and such others as might be obtained, and to lease territorial rights thereunder. Forty-nine per cent of the stock of the company was given to the inventor. The remaining stock, except for allotments to those initially interested, was put into the treasury for sale as occasion might arise.

About this time the article was brought to the attention of a gentleman who not only was keen-sighted enough to perceive the possibilities of the enterprise, but, what was very much more essential, could get it properly financed. Thereupon a syndicate was formed and the inventor's interest purchased for cash and a participation in the syndicate. Both the patent and the licensed companies were also bought up and a reorganization effected. Experienced men were put in charge of the several departments of the work in which each was expert; new uses for the original container were found; and from time to time modifications of the machinery produced modified containers which still further widened its scope and usefulness, opening up new channels of profit.

As it was now felt that one might justly claim the enterprise fairly launched, the inventor ceased to participate actively, believing himself mentally unfitted, as most inventors probably are, to enjoy the purely commercial side of an enterprise.

SECOND PRIZE ARTICLE.

How I Conceived My Invention.

A MACHINE FOR MAKING FLORISTS' FLOWER POTS.

BY "CLAY BALL" (L. A. M'NEIL, BEAVER CROSSING, WIS.)

MAYWOOD, ILL.

In the summer of 1875 I found myself in financial straits, with nothing to do but look for a new position. I lived in Connecticut. During my search for work, I entered a pottery one day where flower pots were made. I promptly applied for a position, and told the proprietor that I was not a potter, but willing to do anything that was honest at his own valuation of my services. He replied simply that there was nothing for me. To be sure, he did need a man who could "turn" saucers, but it was quite necessary that they should be "turned" according to his ideas and methods.

"Suppose that under your instruction I should succeed. Will you give me work?"

"Yes," he replied; "a steady job. But you would not earn anything for at least six months, if at all."

A cheerful prospect that.

"I'll try," I said, "until something turns up."

He assigned me to a "crib," a new thing to me. I found myself chasing a ball of clay on a revolving wheel head, trying to make it come to a center. If you know what that means, you will understand that when 6 P. M. arrived, the future looked anything but rosy, and my frame of mind was anything but optimistic.

Next morning I returned to the crib, despite my disheartening experience of the previous day. To be brief, I began to earn wages in six weeks, instead of the six months of which the proprietor had gloomily spoken when I first applied to him. This was making history in the potter's trade.

My evenings gave me much leisure time for thinking and reading. I read much ancient history. When I found out what the ancients had done, I remarked to the proprietor one day:

"Two thousand years ago the Egyptians used crude machinery like this. Yours is just as crude as theirs. Is it possible that no advance has been made in two thousand years?"

"Clay," he replied, "is very obstinate to mold. A machine for molding it was constructed once, I believe, but it was not successful. A square pot, for example, would be a very fine thing for florists' use, but it can't be made, at least by machine."

"How about a steady job," I asked, "if I construct a machine that will produce both square and round pots?"

He laughed and retorted:

"Such a machine would mean steady employment for you."

"I'll try it," I said.

He smiled a smile of sweet incredulity and turned away.

The advantage of a square over a round pot is perhaps worth noticing. Florists use the smaller sizes in very large quantities. The sizes range from 2 inches to 4 inches across the top, and advance in quarter-inch steps. The capacity of a 2-inch square pot is equal to that of a 2¼-inch round pot. Hence the answer to the question: "How much less shelf room would a 2-inch square pot occupy?" is solved by a simple mathematical computation. This is only one item involved in the question of economy to the florist, it appeals to the manufacturer as well, because to him it means an economy in drying room space, saggers, kiln setting, packing, and every detail of the manufacturing process.

I had no idea how to go about the task I had set for myself. Besides, I was crippled by lack of money. I put on my thinking cap, however, and wore it twenty-four hours a day. I began to make experiments. There were as many failures as there are stars. When cold weather came my opportunity came with it. Clay is egregiously adhesive, especially under pressure. It was my aim to obtain what I wanted by a direct, rapid stroke with vertical pressure in contradistinction to the ancient revolving processes still in vogue.

I could master the mechanical movements easily enough, but I could not devise a way to cause the iron dies to shed a perfect pot. One cold morning, as I was standing by the stove in conversation with a friend, I mechanically tapped a ball of clay which I happened to have in my hand against the warm stove. It flashed on me, "Here is the solution. There is no resistance. Heat your dies."

That evening I placed a lighted kerosene lamp under the dies, and when they were well heated set the plunger going. Presto! A perfect two-inch square flower pot was the result.

The next morning I exhibited several specimens of the square flower pot at the shop. The proprietor was visibly astonished.

"This is the first time in the history of pottery," said he, "that a square flower pot has been made. How many can you make?"

"As many as you are willing to pay for," was my retort courteous. To be brief, I caused a practical working machine to be constructed, operated by hand power, using steam for heating the dies.

The raw material was taken from the bank and left for a time to disintegrate. The box was constructed of lumber, 3 feet square and high. A vertical wooden shaft, 8 inches in diameter, was supported by bearings at both ends with several steel knives about 15 inches in length. These projected at right angles from the axis. A horizontal sweep for horse-power constituted the pug mill, in which the disintegrated clay was thrown. While the knives revolved, the attendant added clay and water from time to time until the material was of the proper consistency and temper. The revolving knives formed a cylinder of clay within the square solid mass, which may possibly have suggested the cylindrical iron pug mill now often found in many shops. When thoroughly mixed the clay was passed up to the turners in large plastic lumps, and placed upon their benches, where they sliced it with wires, extracted stones and other foreign matter, molded it, slapped it, eliminated the air bubbles, and manipulated the mass to a firm, compact body. It was then made into balls of the proper size for throwing.

Clay for the machine went through the same process up to delivery to the turners, but was not manipulated otherwise than to cut it into balls of the proper size. I employed only a boy to assist me. Together we performed all the labor, including the making of the balls, keeping up steam, which was utilized for heating the dies. The vertical plunger was connected with a hand lever 8 feet long, operated by the boy. The mechanical movements were so adjusted that as the plunger ascended a finished pot was lifted from the matrix ready for removal to the drying board. The speed was limited only by the dexterity of the operator who fed the machine and removed the pots. Had steam been used to operate the plunger, the output would have been increased 50 per cent.

I set the machine up in the shop and was commissioned to make 250,000 pots at an agreed price. When I started up, the machine turned out 5,000 pots per day. By hard work a hand turner could turn out about 800 pots a day. I made 43 pots in a minute by the boss's watch. My wages were $7 per day, and my pots were produced so rapidly that there was no room to dry them. This was too much for the proprietor. According to his notion, a laboring man should not earn so much a day, besides flooding the shop with his products. He repudiated his contract, which was easy, because it was oral.

Because of my poverty, the proprietor expected I would want to compromise. Instead, I removed my plant to the machine shop where it was constructed, mailed a few circulars, and received some replies, one from a prominent manufacturer of Cincinnati, who came to see the machine. We agreed on a price, which he paid, and I turned over everything to him. After I paid my debts, I was as poor as ever, but rich in experience.

If I had had capital at that time, I should have undertaken to build up a business for myself, and I would have been successful; for I believe I was the very first person who ever applied heat to dies for making clay products.

THIRD PRIZE ARTICLE.

How I Invented My Fabric-tufting Machine and My Fabric Implement.

BY "D. R. DANIEL" (D. M. CHAMBERLAND, MINNEAPOLIS, MINN.)

When I was married about two years, I found that

rags had accumulated in our house. I was only a lumber inspector at a small salary, and could not afford to buy expensive rugs or carpets. My wife thought that the old rugs might be converted into floor coverings. She cut up some old clothes into narrow strips and inserted the rags with an old-fashioned rug hook into a coffee sack held on a frame.

The process was slow, and I suggested the use of a darning needle. She laughed at me. Not satisfied with her decision, I put a canvas in a frame, threaded the strips of rags in the eye of a darning needle, and inserted the large end of the needle (not the point) into the canvas. When I pulled out the needle, however, the rag would also come out. I flattened a sharp stick of wood, and inserted it alongside of the needle between the needle and the rag after the needle had been inserted in the canvas. Then, while I pulled out the needle, I held the stick in place. After the needle was removed I pulled out the little stick or loop holder, and found I had formed a loop.

My next step was to make a wooden needle and loop holder, and to secure them on two blocks. I succeeded in making more loops. After the invention had been somewhat more perfected, I made a model and sent it to Munn & Co., and eventually received a patent. After the letters patent had been granted I made a fine coat, vest, and cap for myself with the machine. I used fawn-colored zephyr for the collar of the coat, and black German knitting yarn for the body. Everyone thought the coat collar was of otter fur and the body of astrakhan. I thereupon renamed my machine a fabric implement, because it made a fabric which was an imitation of astrakhan.

In making my coat I took for a pattern an old coat which I had. This I ripped apart. Next I took a piece of Java canvas (burlap could have been used) and put it in a frame. I marked the pieces of the old coat on the canvas. I made only what was necessary to form the garment. There was no trimming or fitting to be done, as the old coat fit me pretty well. After I had made all the pieces I sewed them together, just as regular fur garments are sewed. The cost of the material to make the coat was $4.25. By shearing the coat collar I made it look just like any other fur. As it stood, the coat was easily worth $75. I know a prominent hotel keeper of Minneapolis who would not sell his coat for any amount of money, simply because his wife made it on my principle.

My success with the coat, vest and cap induced me to try my hand on a child's cloak, an Oriental rug, some fancy work with silk on satin and plush, a piano spread, lambrequins, a table scarf, and banners, all of which were very successful.

I inserted an advertisement in four Sunday papers, asking for someone with $5,000 to take a half interest in the invention. Armed with my coat and scarf to illustrate the use of my device, I knew that I would not have any trouble in finding a partner. On Monday I closed a deal with the very first man who applied to me. He paid $2,000, the balance to be paid in two months. Five days later he took sick and died in two weeks. His widow offered to sell to me for $500 if I liberated her of all obligations, an offer which I accepted.

I next proceeded to contract with a large firm to manufacture the invention at ten per cent royalty. I gave them my press, dies, and 3,000 machines. Six months later I thought it was time for something to be paid to me by way of royalty. I wrote. They answered that they had not yet commenced to manufacture, and that their circulars were not even printed.

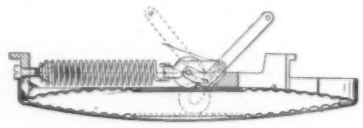
They put me off for six months more. Losing patience, I began an investigation, which resulted in the discovery that the company was financially embarrassed. It took me thirty months to get my patent back. The dies and machines that I turned over to them were full of rust, and were practically worthless. I sued the company for damages, but before my case came up the firm was declared bankrupt.

During this time I had mortgaged all that I had. Everything was taken from me. I had lost everything except courage. I rolled up my sleeves, made a few machines by hand, sold them, and raised $10. Out of this I paid $6 for a cook stove. I bought other furniture amounting to $16 on credit, and also bought some groceries and a pair of shoes. I made my machines by hand until I had enough money to get some dies made. For a whole year I canvassed from house to house. On one memorable day I made $60. On some other days I made $25. At a fair I cleared $800. Finally I secured many agents, and became fairly prosperous. My first machine was made of brass. It cost $2.50, and retailed at $5. In five years, however, I made valuable improvements and brought the cost of manufacture down to only ten cents. This new machine retailed at $1.50. In eighteen years I sold over 300,000 in the United States.

I have raised a family of ten children, have a good home, and money enough for the rest of my days. On account of old age and sickness I sold my business three years ago. It is still running under the old name, and is still selling machines at $1.50, reaping good profits. My invention is of great value among wealthy people as well as among the poor, for the rich people do not take into consideration the worth of the goods which they make, but rather the power of their goods to ornament their homes. With them, handwork is a recreation and not a necessity. My invention is useful among poor people because it gives them means of earning money in a fairly easy way at the fireside, and, what is more, make that money with old worn-out garments that otherwise would be thrown away.

ODDITIES IN INVENTIONS.

Thermostatic Motor.—A very sensitive device has recently been invented for regulating the dampers of a furnace, according to the temperature of the room in which the device is located. It consists of a metallic thermostat secured to the wall of the apartment, and employs a volatilizing liquid which, when the proper heat is reached, dilates a metallic chamber, thereby throwing a bell crank connected by a system of wires or cords to the furnace damper. The chamber is made of two dished tin plates, fitted one within the other. The inner plate, which serves as



THERMOSTATIC MOTOR.

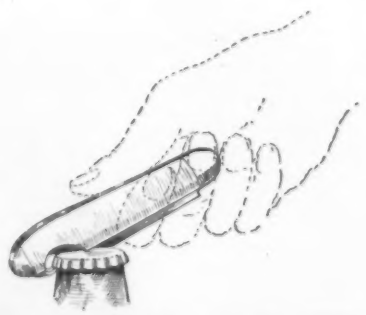
a diaphragm, is corrugated, and provided at the center with a reinforcing plate. In the normal position, this diaphragm occupies the position shown by dotted lines. The roller of the bell-crank lever bears against the reinforcing plate, and when the chamber is dilated, the roller is forced out, swinging the bell crank on its pivot, and thus operating the dampers. In order to regulate the thermostat, so that the liquid will vaporize or boil at a higher temperature, an adjustable coil spring is provided, connecting the bell crank with one side of the thermostat.

Ventilated Shoe.—Three men residing in Kansas City have recently put their heads together, and evolved the ventilating scheme illustrated in the accompanying drawing. The shoe is provided with a sort of pump at the heel, which is operated auto-

VENTILATED SHOE.

matically when a person is walking to keep the air within the shoe in circulation. The pump, which is in reality a spring-pressed bellows, acts also as a cushion for the heel, enabling the wearer to walk easily and with a springy step. It will be observed that air passages run from the pump to the instep and to the ball of the foot.

Combined Knife and Bottle Opener.—A very simple attachment for a knife has been suggested by a New Jersey inventor, which doubles the usefulness of this device. It consists in a curved hook which projects



COMBINED KNIFE AND BOTTLE OPENER.

slightly from one end of the knife handle, and is adapted to engage the edge of a metal sealing cap of the type commonly used on bottles. The handle of the knife is cut away adjacent to the hook, to permit of applying the device, as shown in the illustration.

Brief Notes Concerning Inventions.

It is quite the common thing to fit a pencil with an eraser. But one is just as liable to make an error with a pen; why not, therefore, provide pens with some means of erasure? The question has been answered by a recent patent, disclosing a penholder equipped with a scraping blade which may be moved into position for use whenever desired. The blade also provides a convenient rest for the fingers when holding the pen.

Travelers who find themselves in places where there are no ready means for hanging up a hat and coat, will be interested in a vest-pocket hanger that has just been invented. This consists of a hook for the coat and a pair of spring prongs, which may be pressed into engagement with the rim of a hat by means of a sliding sleeve. By means of a sharp hook the hanger may be suspended from any projection, such as a ledge or the molding on a door.

To protect a sharpshooter without interfering with his aim, an officer of the Austrian army has devised a shield which is fastened to the barrel of the rifle immediately in front of the trigger, and held in inclined position by means of a spring. This shield is slotted, permitting the rifleman to take aim through the slot. Should a bullet strike the shield, the latter will yield, destroying the impact of the bullet, and at the same time deflecting it, so that it is thrown harmlessly upward. The shield may be painted of such color as to mask the sharpshooter thoroughly, and baffle the enemy's aim.

In August, 1861, the printing of duplicate copies of patents was inaugurated by the Patent Office, and within the past year the work of printing the specifications of patents issued prior to 1861 has been taken up. So far, about five thousand of such patents have been printed, so that it is now possible to obtain a printed copy of any patent issued since 1855, while the specifications of all patents in some classes have been printed. The sale of patent copies has increased to a remarkable degree in the last decade. The records show that 1,336,343 copies of patents were sold during the fiscal year ending June 30th, 1909, while 2,257,444 copies were sold during the year ending June 30th, 1910, an increase for the year of 921,101. Two and one-fourth miles of shelving are required for the storage by the Patent Office of the patent copies now held for sale. This shelving lines the walls of many of the Patent Office halls from floor to ceiling, and the accumulated copies are rapidly using up all available storage space.

Legal Notes.

According to a decision which was handed down by Judge Morris, in Kinder and another against Poulsen, 109 Pacific Reporter, 795, a well driller must be careful of his tools while drilling for water, because if he loses them in the well he cannot hold the owner liable for the board of his men and horses while fishing for them. In the case mentioned defendant agreed to pay by the foot for drilling a well on his premises, and to furnish coal and board plaintiffs' men and horses. The court held that defendant was not bound to furnish coal for a period of six weeks during which plaintiffs were fishing for the lost tools, where they were lost through the negligent operation of the drilling machine.

Can a trade mark be licensed like a patent? The fundamental idea of trade-mark rights rests upon the claimant's being entitled to the exclusive right to the mark, and it is very dangerous for any trade-mark owner to permit the use of the mark by another on the same class of goods. In a well-known English work on the subject it is said: "There is no such thing as licensing another to use a trade mark. If the owner of the trade mark permits it to be used in connection with other people's goods, he loses his claim to it." In a case in the United States, where the owner of a trade mark licensed another to use the mark on machines of its own make, the court held that the agreement was invalid and fraudulent and that the plaintiff could not recover under it.

The decision of the Circuit Court of Appeals, Seventh Circuit, in the General Electric Company versus Richmond Street and Interurban Railway Company, Fed. Rep. 178, page 84, presents somewhat advanced views on the question of reissues. Thus the court says: "Either the original specification must be defective or insufficient, or the original claims must embrace more than the patentee had a right to claim as new" to authorize the Commissioner of Patents to grant a reissue; and the court concluded that the reissue was made for the purpose of holding a wider monopoly than could have been built up under the invention as disclosed in the original patent, and held the grant utterly void. Without the existence of one or the other of the two specified conditions precedent, the Commissioner of Patents, the court holds, is not authorized to grant a reissue. It is understood that application to the Supreme Court for writ of certiorari in this case was denied. 216 U. S., page 620.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

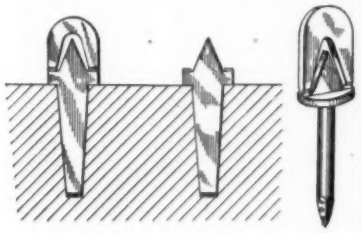
PNEUMATIC CUSHION FURNITURE.—WILLIAM E. KURTZ, 90 Echo Avenue, Oakland, Cal. Pictured in the accompanying engraving is a section of a chair fitted with pneumatic cushions, furnishing a very soft and comfortable seat and back. To hold the

PNEUMATIC CUSHION CHAIR.

cushions in place, the chair is provided with spacing members that round out the cushions where they meet the framework. The forward part of the chair is provided with a spacing member mounted on springs which assist in holding the part in shape. The cushions are provided with valves and nipples, whereby they may be inflated when they have become partially deflated by leakage.

Hardware and Tools.

NAIL.—CHRISTIAN HANSEN, Escobedo y Plaza Hidalgo, Monterey, N. L., Mexico. The present invention relates to nails having a head provided with a spike which is left projecting after the nail has been driven. The

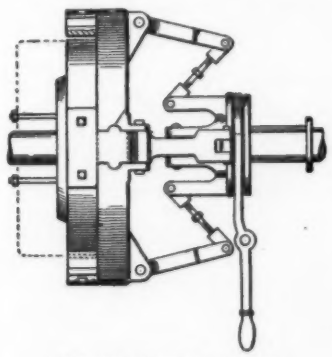


SPIKE-NAIL AND DRIVING HEAD.

head of the nail is furnished with a guard over the spike, and is driven by directing the blow to the hammer against the top of the guard. After the nail has been driven home, the guard is knocked off by a side blow. Thus the spike is not injured. Such nails are used for the tops of fences and other places to provide protective spikes.

Machines and Mechanical Devices.

FRICTION CLUTCH.—JOHN A. FRIDGEN, R. F. D. No. 2, Vining, Minn. The clutch here illustrated is provided with friction blocks or shoes mounted to slide radially in a head secured to the shaft and adapted to be moved into contact with the peripheral face of a pulley. This engagement is effected by sliding a



IMPROVED FRICTION CLUTCH.

sleeve toward the head and thereby operating a set of arms which have rack and pinion engagement with the blocks. These arms are adjustable, so that the bearings of the shoes may be made uniform.

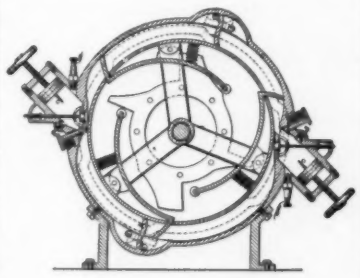
Prime Movers and Their Accessories.

PISTON.—E. TALBOT, New York, N. Y. This piston is more particularly adapted for use in light internal combustion engines. The invention provides a construction of very small weight and great rigidity, with provision for easily securing a piston pin of small diameter. Incidentally, the bearing for the pin is removed to a considerable distance from the hot cylinder walls.

EXHAUST-VALVE FOR INTERNAL-COMBUSTION ENGINES.—T. J. KOVEN, 235 Sherman Avenue, Jersey City, N. J. The aim of this inventor is to provide a valve arranged to keep the valve cool and thus to prevent the accumulation of soot and premature explosions. To cool the valve, a cooling medium, such as water, is circulated through the valve, and the inlet and outlet for this medium are arranged so as not to interfere with the proper working of the valve.

VARIABLE-SPEED APPARATUS.—W. B. ALLYN, Whitesboro, N. Y. This invention is a variable speed transmitting apparatus of the hydraulic type, a liquid, such as water or oil, being used as the medium for conveying force or power from the driving to the driven shaft or element. It is particularly adapted for use on motor vehicles, and in other places where the load or resistance varies, and is, in fact, applicable to any situation where it is desirable to vary the speed between the driving and driven medium.

INTERNAL COMBUSTION ENGINE.—GEORGE M. PERLEWITZ, care Superintendent F. C. N. de M. Chihuahua Shops, Chihuahua, Mexico. This is a rotary engine having a high pressure side and a low pressure side. Explosions take place in the low pressure side and the gases of combustion in expanding pass to the high pressure side and there do a

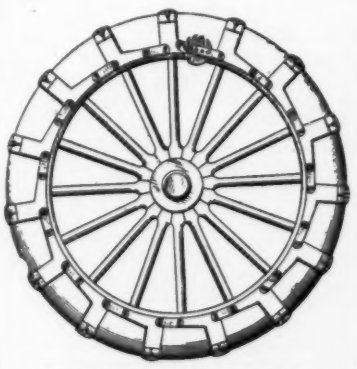


INTERNAL COMBUSTION ENGINE.

part of their work. Air is taken in on the low pressure side, given a preliminary compression and passed to the high pressure side, where it takes part in the explosions. The levers for moving the engine are provided with accurate pistons which are moved inwardly and outwardly by levers, these levers being balanced so as to compensate for centrifugal action upon them.

Pertaining to Vehicles.

ANTI-SKIDDING DEVICE FOR TIRES.—J. E. REDMOND, 853 South Main Street, Butte, Montana. To prevent wheels of a vehicle from slipping on wet or muddy surfaces, and to protect tires from wear and tear, Mr. Redmond has invented an anti-skidding armor made up of separate U-shaped members that are fitted over the tire or shoe and are con-



ANTI-SKIDDING ARMOR FOR TIRES.

nected by means of links. The entire chain of U-shaped members may be tightened up on the tire by means of a convenient ratchet device. Each member is formed with a raised tread surface.

DRIVING-GEAR FOR AUTOMOBILES.—J. A. SCHARF, Richwood, Ohio. This improvement provides a running gear for automobiles, in which the mechanical expedients of positively engaged members successively operated, are avoided; provides a running gear wherein the equalizing gear comprised of cog wheels, is avoided; provides a differential action for the driving wheels of the running gear, actuated by the steering gear; and provides a mechanism for operating the driving wheels of the running gear.

MOTOR-CYCLE FRICTION CLUTCH.—J. R. SPANGLER, New York, N. Y. In the present patent the invention has for its purpose to overcome the shock and vibration in vehicles propelled by explosive engines, more especially motor cycles, incident to the firing of the charge when the motor cycle is first started, or after it is started when the load is very heavy, as when climbing a hill.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12334) F. S. S. asks support in his contention in an argument that a bullet from a rifle barrel goes farther and more accurately than if fired from a smoothbore. A. Rifling a gun barrel is done for the purpose of causing a twist in the bullet, which prevents the bullet from turning end over end in its flight, and keeps its axis on the line of flight. The friction of the rifling grooves upon the bullet very slightly decreases the velocity with which the bullet leaves the barrel, but at that the flight is much swifter and more accurate than would be the case in firing the same bullet with a smoothbore. You are therefore correct in your contention that a bullet from a rifled barrel goes farther and more accurately than a bullet fired from a smooth barrel, even though the muzzle velocity of the rifle bullet is slightly less than if it were fired from a smoothbore.

(12335) C. K. says: Will you kindly give us some information in your valuable paper as to the frequency of ships fouling a water spout, as to the amount of damage to be expected by a ship under such circumstances, and the methods used by mariners to avoid or overcome water spouts? Does shooting a bullet through a water spout tend to break it? Also, what causes or is supposed to cause water spouts? A. A water spout is due to the same cause as a tornado on the land. It is an intense whirling storm of small area. The air rises in the center of the whirls, and is thus drawn in toward the center from the outside. The friction of the air upon the surface of the water raises water from the ocean into the central funnel, and it afterward falls all around in large quantities. We have no information as to the method of avoiding a water spout by a ship, nor do we think that a shot is likely to break a water spout up. You will find chapters upon such storms in the books upon meteorology. We can send you the latest, Moore's "Meteorology," for $3 postpaid.

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Composing machines, matrix delivery mechanism for monoline, W. F. Bertram 975,503
Computing machine, F. F. Main 976,089, 976,087
Concrete pile or column, reinforced, R. A. Cummings 975,514
Concrete structures, apparatus for casting, H. French 975,943
Condenser, D. G. Galbraith 975,612
Conduit hood, L. A. Fleury, Jr. 975,757
Conveyer, J. F. Russell 975,721
Conveyer mechanism, J. Mussell 975,565
Conveyers, deflector for gravity, M. C. Schwab 975,800
Cooker, fireless, A. T. Hallock 975,416
Cooking utensil, M. T. Duffy 975,843
Corn from the cob, machine for cutting green, S. E. & W. W. Morral 975,631
Corset, apparel, D. Kops 975,771, 975,772
Couch or bed, extension, W. M. Taylor 975,486
Countersink, J. E. Freyman 975,944
Covers, means for removing, D. R. Levin 975,698
Crate, E. L. Walker 975,661
Crucible holding device, E. P. Carr 976,042
Cultivator, E. E. Meloen 975,975

Cultivator, W. S. Wilburn 976,020
Cultivator attachment, J. Meyer 975,976
Curtain and shade fixture, Page & Tremblay 975,568
Curtain pole, C. Hunt 976,128
Cuspidor, P. A. Petrie 975,890
Cuspidors and like articles, stand for, M. Fiset 975,941
Cutter bit changing means, rotary, E. C. Morgan 975,563
Cutting irregular forms, machine for, A. M. Stickney 975,652
Cycle saddles, mounting for motor, S. Busch 975,827
Derrick, adjustable, G. W. Brown 975,505
Dish washer and pot cleaner, R. Quarrelee 975,716
Disinfecting apparatus, L. E. Bach 975,955
Display case, card, H. A. Shannon 975,644
Ditching machine, F. B. Winkelman 975,593
Diving apparatus, G. W. Smith 975,727
Door check, J. Suter 975,805
Door guard, O. Freyberg 975,760
Door guide bracket, sliding, J. Gauthier 975,761
Door lock, F. Assmann 975,819
Door locking mechanism, emergency, A. J. Provost 975,456
Door opening and closing device, H. C. Bundy 975,507
Door, revolving, Clymer & Degen 975,510
Door operating mechanism, P. J. Harrigan 975,800
Doors, windows, etc., fastening device for, P. T. Molkentin 975,977
Dough portioning into loaves, machine for molding, J. & H. L. Callow 975,932
Draft gear, radial, E. H. Schmidt 975,896
Drain trap, floor, W. Weller 976,108
Drawing board attachment, J. W. Wells 976,019
Dredging, pontoon pipe for marine, Richards & Loga 975,999
Drier. See Clothes drier.
Drying reel for clothes, etc., Waggoner & Heard 975,990
Drills, scraper device for disk, O. G. Rieske 975,459
Drilling machine, multiple, O. A. Smith 975,729
Electric arcs, production of long stable, O. Schonherr & Hessberger 976,002
Electric cable joint, W. O. Wilson 975,592
Electric circuit interrupter, R. P. Jackson 975,431
Electric circuit protection system, F. W. Harris 975,420
Electric circuit switch, F. W. Harris 975,417, 975,419
Electric furnace with magnetically rotated charge, H. N. Potter 975,571, 975,794
Electric heater, Parkhurst & Weeks 975,712
Electric iron and stove, combined, B. R. Charles 975,936
Electric machine, magneto, Daugherty & Johnson 975,401
Electric machines, armature winding for dynamo, N. W. Storer ..... 975,476 to 975,478
Electric machines, field winding coil for dynamo, W. Heasley 975,425
Electric plug and socket, L. W. Kutsch 975,875
Electrical apparatus, device for testing, H. B. Lehman 975,879
Electrical circuits, multiple fusible cut-out for, A. E. Partington 975,569
Electrical conduit attachment, A. McMurtrie 975,777
Electrode for reversible galvanic batteries, W. Morrison 975,981
Elevator. See Portable elevator.
Elevator safety device, A. L. Bush 975,828
Elevators, alternating current controlling apparatus for hydraulic, D. L. Lindquist 976,130
Engine priming device, explosive, B. Ruck Boschet 975,639
Engine starting apparatus, gas, C. H. Oslund 975,567
Engines, ignition means for internal combustion, M. B. Crist 975,512
Envelop, W. A. McCloy 975,627
Envelop, expansion, R. W. Pittman 975,792
Excavator bucket, O. J. Martinson 976,088
Expanding or adjustable press for fertilizing material, etc., Overton & Ketcham 975,990
Explosive, F. H. Briggs 975,825
Explosive engine, G. L. Fogler 975,406
Extension table, pedestal, C. J. Brown 975,604
Fabric chain machine, J. F. Gail 975,850
Fan, spring motor driven table, D. M. Pfautz 975,714
Faucets, hose conection for, B. D. Knickerbocker 975,873
Fence, S. Hoshlin 975,428
Filter system, F. Turck 975,483
Filtration system, S. Ouimet 975,450
Fire engine, H. M. Minnis 976,133
Fire kindler, S. Ishii 975,808
Firearm, A. I. Risser 975,720
Firearm, automatic, C. P. Clement 976,122
Fireproof buildings, partition construction for, R. Hill 975,426
Fish catching device, automatic, Becker & Poggensee 975,822
Fish hook, J. Y. Payton 975,993
Fish hook, shell, J. F. Roepple 975,927
Fishing reel, P. F. Wadham 975,587
Fishing reel, W. F. Stockford 975,653
Floor finishing and polishing machine, W. O. Caufield 976,040
Floor set, F. Norton 975,566
Flower stand, W. Gaethje 976,061
Flue receiver, adjustable, J. J. McDonald 975,703
Fluid pressure appliance, T. S. Scott 975,467
Fly killer, C. H. Porter 975,570
Fog horn, Kleinberger & Stern 975,900
Form, skirt, R. C. Shaffer 975,724
Fruit cleaner and grader, I. W. Peck 975,452
Furnace, E. Katzinger 975,531
Furnace, Poppenhausen & Harrington, reissue 13,168
Furnace cover, crucible, J. L. R. Brown 975,506
Furnace door, J. Robinson 975,892
Furnace for the production of cast iron and steel, F. Resinelli 975,908
Furnace head for gas furnaces with changing direction of flames, B. Versen 975,738
Furnace structure, J. Eggins 975,754
Fuse clipper and splitter, miner's combined, S. H. Lunsford 975,908
Gage. See Testing gage.
Gage glass, F. R. Bispham 976,030
Galvanic battery, reversible, W. Morrison 976,092
Garment hanger, G. V. Nichols 976,094
Garment rack, J. C. Sassenberg 975,799
Garment upporter, Lingo & Kaufman 975,700
Gas burner, blast furnace stove, A. G. McKee 975,556
Gas engine, J. B. Brown 976,034
Gas generator, A. Wallace 975,743
Gas generator, acetylene, V. E. Peterson 976,135
Gas mixer regulating device, P. Lulli 975,444
Gas producing apparatus, F. H. Treat 975,657
Gate, Doty & Kirkland 975,516
Gate, B. J. Campbell 976,119
Gear, gapped, W. T. Sears 975,722, 975,723
Gear wheel, R. C. Bloomfield 975,745
Gearing, T. A. Panyard 975,789
Gearing, controlling mechanism for change speed and reversing, A. P. Brush 975,393
Gearing, variable speed, R. Lindsay 975,442
Glass blowing machine, W. D. Fredrick 975,758, 975,759
Glass cleaner, L. G. Hatosy, Jr 975,802
Glass making apparatus, sheet, F. M. Francart 975,125
Glassware mold, G. W. Fry 975,409
Gouge, J. A. Suckley 976,106
Grain separator, F. Ayler 975,598
Grain separator cleaning attachment, E. Prinz 975,995
Grate, heating, E. R. Cahoone 976,039
Grate, hollow water heating, L. Kaufman 976,080
Grinding machine, A. Lilljiquist 976,966
Grinding machine attachment, flat surface, M. J. Neumath 975,785
Grinding mill, K. O. S. Thors 975,807
Grinding mill, rolling balls, L. Hoffmann 975,864
Gripping mechanism, C. A. Morris 975,710
Gun, trap, C. D. Lovelace 975,967
Gyroscope and sphere, J. F. O'Byrne 975,988
Hair pin, L. C. Belz 975,390
Hammer drill, W. Prellwitz 975,891
Hammer drill, A. H. Taylor 975,905
Hand rake, O. Kampfe 975,871
Hand shield, L. B. Tebeau 975,734
Harvester, beet, M. H. Wadhams 975,586
Harvester, corn, R. E. Reed 975,797
Harvester, cotton, G. Hapgood 975,775, 976,041
Harvester, cotton, D. D. Miles 976,132
Hat, S. Newman 975,448
Hat pin guard, Hutchison & Andrew 975,620
Hat protector, L. F. Wolfe 975,667
Hatch fastener, A. Hynd 975,528
Hay carrier, Davis & Evans 975,836
Head envelop, R. A. Bower 975,445
Heater. See Electric heater.
Heaters, condensate collector for water, E. Rund 975,894
Heating by means of radio incandescent bodies, system of, M. Delage 975,837
Heating system, indirect water, E. Rund 975,895
Heel plate, E. W. Gray 975,704
Heel, shoe, J. Colbert 975,397
Hides or skins, unhairing and tanning, G. D. Burton 976,036
Hinge and receptacle, combined, W. D. Hodson 975,690
Hoisting device, R. L. Lamberton 975,876
Hoop, J. Dupree 975,679
Horseshoe anti-slipping attachment, J. J. May 975,553
Horseshoe spreader, C. Vestergaard 975,810
Hose bridge, M. E. Troutt 975,658
Hydraulic chair, E. Melchior 975,705
Hydraulic press, F. Phelps 975,994
Hydrocarbon vaporizer and burner, C. Mendell 975,557
Ice making apparatus, W. H. A. Halsall 975,523
Impaling roll, E. L. Chaddock 975,831
Index tab, W. F. Harrod 976,073
Infusions, apparatus for preparing, Korn & Kuhn 975,874
Ingot mold, W. H. Connell 975,511
Inner sole, D. Sexton 975,576
Internal combustion engine, C. R. Radcliffe 975,796
Internal combustion engine, T. Veitch 975,809
Internal combustion engine and operating the same, C. J. Sabathe 975,640
Internal combustion engine, rotary multiple cylinder, J. A. Waltman 975,485
Iron from its ores, extracting, S. G. Martin 975,625
Jar or receptacle, R. H. Wolff 976,021
Jeweler's and dentist's burner, A. & C. Zarembowitz 976,112
Journal box, J. E. Osmer 975,449
Journal wheel, W. L. Bodman 975,744
Kerosene burner, E. F. Gennert 975,411
Knife, fork, and spoon holder, R. C. Guy 975,858
Knives, machine for milling slicing, V. E. Dobbs 975,839
Knitting machine needle, R. W. Scott 975,466
Ladder, folding scaffold, H. F. Hartman 976,074
Lamp, C. W. Boyce 976,117
Lamp and mirror, combined, L. A. Buell 975,674
Lamp, arc, T. L. Carbone 975,935
Lamp burner, W. H. Burnett 975,929
Lamp cut-out and shunt switch, electric, Wagner & McDonald 975,484
Lamp, incandescent gas, E. Mineer 975,561
Lamps, making mantles for incandescent gas, ... 975,769
Last, F. W. Millay 975,708
Lathe gearing, A. V. Carroll 975,748
Laundry apparatus, R. C. Merritt 975,706
Lavatory fixture, E. G. Watrous 975,663
Lead, apparatus for manufacturing sublimed white, L. S. Hughes 975,768
Lead, manufacturing sublimed white, L. S. Hughes 975,867
Leaf support, T. Hauser 975,796
Leather skiving machine pressure device, Bayley & Mayo 975,495
Leather working machine, G. McKeen 975,628
Leg, artificial, H. T. Odgers 975,858
Level, H. J. Carrigan 975,850
Lifting jack, T. H. Lovejoy 975,548
Lighting fixture, G. D. Beinert 975,823
Lighting system, hydrocarbon, C. K. Harding 976,127
Limb, artificial, T. M. Lawrence 975,459
Line casting machine, D. S. Kennedy 975,433, 975,434, 975,460
Liquid fuel burner, J. P. Roberts 975,955
Litharge from metallic lead mixed with it, freeing, L. S. Hughes 975,849
Loader and stacker, R. B. Fulton 975,917
Loading apparatus, Woods & Harding 975,880
Lock. See Can lock.
Lock, H. Markovitz 976,028
Lock actuating mechanism, time, E. M. Benham 975,892
Lock box, G. Schwinn 975,675
Lock strike, E. J. Bumiller 975,546
Locking means, closure, C. J. Ljunggren 975,455
Locking mechanism, A. J. Prevost 975,443
Locomotive and other vehicle fender, M. Lo Celso 976,014
Locomotive, articulated, S. M. Vauclain 975,870
Locomotive attachment, Jones & Minehan 975,404
Locomotive, electric, G. M. Eaton 976,120
Loom bobbin, J. P. Chatel 976,009
Loom picker mechanism, D. Thiebault 976,076
Lubricator, F. C. von Haxthausen 976,126
Machinery, bed plate for, F. Gerb 975,842
Magneto interrupter, W. E. Dow 975,679
Mail bag catcher, W. A. Carpenter 976,041
Mail receiving and collecting device, R. Martini 975,552
Manhole form, P. G. Harshbarger 975,525
Massage apparatus, vibratory, F. R. Kunkel 975,436, 975,437
Massaging apparatus, E. J. McCarthy 975,702
Match box, D. C. Moore 975,978
Match stand and ash receiver, E. Lafleur 975,438
Mausoleum, T. J. Moore 975,779
Measurer, dry, J. J. Marshall 975,701
Measuring device, J. Gillette 976,066
Mechanical movement, W. A. Whitney 975,591
Mechanical movement, C. R. Uehelmesser 975,659
Melting furnace, oil heated, A. T. Brown 975,826
Melting furnace, charging, M. R. Conley 975,751
Metal corner, C. Mork 976,134
Metal scrap compressor, S. W. Egbert 975,844
Metals, means for applying fluid, W. H. Smyth 975,731
Metallic leaf in rolls, machine for packaging, C. E. Smith 975,472
Metallic tie and rail fastener, S. Stammler 975,902
Meter box, J. W. Butts 976,038
Mill. See Grinding mill.
Mill floor construction, reinforced wooden, C. A. M. Praray 975,923
Mills, grinding plate for attrition, Fraser & Jacobson 975,848
Mining machine, F. L. Sessions 975,468
Miter box, F. Peterson 976,097
Mixing machine, C. T. Foote 975,847
Moistener, finger, H. S. Cates 975,676
Molded mass, producing, Hof & Pieper 975,491
Molding machine, L. E. Pridmore 975,715
Motive fluid, apparatus for generating, G. B. Hayes 976,077
Motor control system, F. B. Rae 975,572
Mower, lawn, A. Hill 975,617
Mutograph, F. C. Newell 976,093
Needling machine, D. S. Brown 976,033
Nut lock, N. Little 975,545
Nut lock, R. Cooper 975,905
Nut lock, I. L. Miller 975,709
Nut lock, F. H. Nett 975,985
Nut lock and tightening device, J. G. Wolfe 975,594
Nut locking device, E. L. J. Schaffelke 975,642
Nut locking tool, R. A. Clark 975,677
Offset preventing device, H. A. W. Wood 976,022
Oil burner, E. W. Tucker 975,482
Oil burner, W. A. Steckens 976,107
Oil burner, crude, G. C. Yale 975,740
Oils, fats, etc., emulsifying, Muller-Jacobs & Bernhardi 975,447
Optical projection apparatus, J. W. Henwood 975,949
Orchard heater, T. E. Fulghum 975,611
Orchard heater, J. Troutman 976,013
Orchard heater, J. L. Hamilton 976,072
Ore classifier, A. D. J. Malchus 975,971
Oven, baker's, W. F. Petersen 975,889
Overshoe fastener, R. E. White 975,815
Packing case, A. T. Kruse 975,962
Packing, piston, H. S. Studdert 976,007
Paint package, semi-solid, L. Reusche 975,718
Pan scraper, G. M. Bates 975,599
Paper feeding machines, sheet registering mechanism for, T. C. Dexter 975,606
Pasting and trimming machine, W. J. Williams 975,666
Pen and pencil holder, X. F. Schnapka 975,465
Pen for swine, farrowing, R. D. Spelts 975,649
Permutation lock, H. C. Lowrie 975,549
Photographic plate holder, J. Becker 975,498
Piano pedal, G. J. Bachand 975,670
Picture apparatus, fireproof receptacle for films of moving, G. J. Gilmore 976,067
Pile, L. E. Welsh 975,488
Pile and means for driving the same, L. E. Welsh 975,487
Pin. See Hair pin.
Pipe attachment, W. E. Tait 975,584
Placer separator, D. J. Forbes 975,684
Planter, corn, F. W. Booth 975,673
Plate shaving, trimming, and tail cutting machine, combined, S. G. Gos 975,521
Plow, W. F. Lindsey 975,544
Plow, S. J. Minyard 975,562
Plow, C. L. Hall 975,614
Plow, I. L. Fake 976,059
Plow point, M. F. McElveen 975,555
Plow scraper, disk, J. J. Shackelford 975,578
Plows, draft appliance for, G. A. Anderson 976,024
Plunger elevator system, T. Larsson 975,540
Pneumatic cleaner and force cup, combined, L. O. Howell 975,527
Pneumatic despatch apparatus, T. Bemis 975,501
Pneumatic despatch tube apparatus, C. F. Stoddard 975,903
Polychrome screen and making same, C. L. A. Brasseur 976,118
Portable elevator, A. Zikmund 975,597
Postal money order packet, J. S. Utley 975,737
Postpoint, G. W. Duncan 975,607
Poultry house, W. G. Stout 975,733
Pouring device, H. Desmolieres 975,937
Powder, size, F. Beckmann 976,116
Power mechanism, J. F. Bard 976,115
Power transmitting apparatus, hydraulic, C. R. Radcliffe 975,795
Power transmitting mechanism, variable speed, J. G. Jones 975,869
Precious metalliferous ores, treatment of, J. C. Clancy ..... 976,043 to 976,045
Printing press, H. J. Smith 975,730
Printing press, M. R. Land 975,963
Printing press ink fountain, R. J. Greenway 975,856
Propeller, G. R. Martin 975,972
Pulley, yieldable, H. P. Motter 975,564
Pulp treating machine, H. B. Saeter 975,798
Pump, air, G. J. Spohrer 975,473
Pump base, J. J. Divekey 975,752
Pump, condenser, and compressor, centrifugal, E. S. G. Rees 975,997
Pump, deep well, J. Hahn 976,071
Pump, motor suction, W. H. Keller 975,532
Pump, propeller turbine, E. K. Hood 975,526
Pump, submerged double acting, A. P. Morris 975,781
Pumping apparatus, centrifugal, Jones & Koppe 975,623
Punching and delivering tickets, apparatus for, W. Clifford 976,046
Purse or bill folder, L. B. Weissbrod 975,813
Rack. See Garment rack.
Rail chair, Knobel & Asay 975,536
Rail clamp, guard, M. Burpee 975,395
Rail fastener, metallic, L. Leaf 975,878
Rail joint, A. D. Shaeffer 975,899
Rail joint and nut lock, combination, H. H. Chase 975,513
Railway rail anchor, Buzby & Hukill 975,747
Railway switch, W. F. Edwards 975,517
Railway switch, J. F. Yoho et al 975,595
Railway switch electric circuit controller, G. M. Thompson 975,585
Railway switch lock, C. P. Knox 976,082
Railway switch structure, F. H. Ellis 976,056
Railway tie and rail clamp, metallic, J. Galambos 975,520
Railway tie, concrete metal, L. R. Gifford 975,855
Ratchet drill, chain breast, S. McClellan 976,131
Razor blade holder, F. C. Gorham 975,762
Razor, safety, L. Knaster 975,535
Razor stropping device, W. H. Shattuck 975,801
Receptacle, P. G. Seward 975,898
Receptacle, C. W. Johnson 975,958
Recording or registering messages, memoranda, etc., device for, J. A. Gamble 976,062
Reflector, lamp, H. Zirwas 975,669
Refrigerator, window cold air, W. M. Howland 975,954
Rerailer, T. W. J. McGann 976,137
Reversing mechanism, A. R. Murray 975,982
Revolver, A. Fyrberg 975,551
Riprapping system, J. M. Maher 975,580
Road machine, W. K. Stebbins 975,783
Road machine, H. B. & H. C. Moulthrop 976,012
Road roller, M. J. Todd 975,637
Rotary engine, A. Renik 975,643
Rotary engine, G. B. Seit 976,066
Rotary motor, L. Stempfer 975,951
Saddle support, E. H. Pinkham 975,717
Safety lock, N. Reinehr 975,451
Salt and pepper shaker, M. F. Pane 975,782
Sand blast apparatus, W. F. Mott 975,961
Sash fastener, J. A. Knasinski 975,496
Sash screen attachment, window, Beck & Kehlstrom 975,930
Sash, window, J. J. Richardson 976,091
Saw filer and set, C. Miller 975,970
Saw table and feeding apparatus, M. M. Maine 976,075
Sawing machine, H. Hastings 975,773
Scraper and fender, combined, D. B. Buttrill 975,499
Scraper for disk openers, E. R. Beeman 975,974
Scraper, wheel, J. R. McClellan 975,441
Screen. See Polychrome screen.
Screen, D. Lewis 975,470
Screen, C. D. Shrady 975,983
Scuttle, G. A. Nelson 975,857
Sealing tool, A. E. Groom et al 975,574
Seaming machine, double, F. Rudolphi 975,796
Self locking bolt, Pausch & Clark 975,989
Sewing machine attachment, J. O. Ostman 976,023
Sewing machine trimming mechanism, R. G. Woodward 975,413
Shaking grizzly, C. H. Gunn 975,946
Shaping machine, T. J. Gilliam 975,575
Shears, F. D. Davies 975,854
Shears, J. W. Chauncey 976,121
Sheet metal cap, C. H. Werner 975,914
Sheet metal pipe, H. Birnbaum 976,029
Shelf, corner, T. W. Hollander 975,619
Ship or vessel, C. J. F. M. Lillichook 975,699
Shoes, corset for, S. Azzara 975,820
Shoring, J. R. Wemlinger 975,665
Shutter clamping device, W. Kyler 975,538
Sifter, ash, J. W. Roper 975,699
Sifter, magazine four, W. W. Hill 975,951
Sink attachment, A. T. McCanlis 975,626
Skate, roller or wheeled, M. S. Mishler 975,446
Skirt, J. A. & W. Grewen 975,947
Sled brake, J. Struve 975,904
Sluice gate, Creager & Harry 975,400
Smoke consumer, J. R. Blaik 975,391
Smoke consumer, C. T. Denis 975,402
Smoke consumer, J. S. Green 975,688
Soldering, Wassman & Widell 975,913
Soldering machine, Wassman & Widell 975,912
Sound deadener for rotary blowers, Gibson & Trinks 976,063
Spark plug, A. Schmidt 976,101
Spectacle mounting, P. Mowes 975,778
Speed limiting apparatus, F. W. Waterman 976,017
Speedometer, W. P. Dun Lany 976,054
Spikenard, milk extract of wild, F. M. Davis 976,051
Spoon holder, G. C. Folckemer 975,683
Spring construction, W. R. Smith 975,579
Spring construction, J. H. Snuggs 976,104
Spring cushion, P. Knuppen 975,695
Spring wheel, A. Moore 975,630
Sprocket, Dorton & Boyer 975,753
Sprocket gear, D. H. Downey 975,938
Sputum receptacle, W. L. Gerard 975,854
Square, jointed, A. Stevens 975,581
Stack cover, C. B. Shedd 975,802
Stacker, straw, G. W. Halane 975,415
Stamp, E. H. Sanborn 975,463
Stamp affixing machine, H. A. Benedict 975,742
Stand. See Flower stand.
Steam and hot water boiler, R. Rouse, Jr 975,462
Steam boiler, W. S. Tuttle 975,736
Steam engine, rotary multiple cylinder, J. A. Waltman 975,486
Stenciling machine, A. J. Smith 975,471
Sterilizing and tempering glass vessels, apparatus for, E. D. Schmitt 976,001
Stocking cap, E. Swindell 975,582
Stoker, underfeed, P. L. Crowe ..... 976,047 to 976,049
Stool, folding, F. von Tiesenhausen 976,136
Stool, shoe salesman's, J. Gassel 972,852
Store service credit system apparatus, C. F. Kettering 975,533
Stove attachment, gas heating, O. Drechsler 976,053
Stovepipe holder, J. S. B. Walker 976,015
Stovepipe thimble, J. A. Brodin 975,746
Straight edge and holder, T. Iwanami 975,956
Strainer, E. P. Gray 975,687
Stretcher, W. B. Reed 975,996
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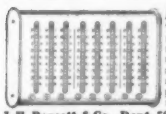

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PHOTOGRAPHING FLIGHT OF PROJECTILES

(*Continued from page 417.*)

Supposing the primary of an induction coil J_3 (Fig. 1) to be fed by direct current opened and closed at regular intervals by a Wehnelt interrupter W or a turbine interrupter, a regular succession of sparks will pass in the secondary circuit between the electrodes of a spark gap F_1, arranged in parallel to an adjustable condenser C_1. These sparks are used for illuminating the moving object to be photographed, a concave mirror serving to concentrate on an objective of small focus as much of its light as possible, so as to produce at each passage of a spark on the rapidly moving film a silhouette of the dimensions of ordinary cinematographic pictures. The endless film f runs over two steel drums R_1 and R_2, one of which is driven by an electric motor. In order to prevent a repeated lighting of the film, a special interrupter is provided for starting the sparking shortly before the beginning of the process to be photographed, and interrupting it shortly after its completion. This interrupter comprises a pendulum P, which in the beginning is kept in position by an electro-magnet E_1 and four parallel circular metal bars, on which are free to slide the make-and-break contacts 1, 2, 3, 4, 5. As the current of the electro-magnet is interrupted, the pendulum is set moving so as to strike contact 1, and thus to interrupt the current in the electro-magnet E_2. After thus disengaging electro-magnetically the shot to be photographed, the pendulum will continue its oscillations, closing contact 2, and thus starting the sparking. As the pendulum reaches contact 3, the sparking is again interrupted. In actual practice the intermittent direct current in the primary of the induction coil J_1 is replaced (as in wireless telegraphy) by an alternate current.

The condenser capacity and the length of the spark gap are checked, at first with the ear, and later by successive photographic tests.

In Figs. 2 to 5 are reproduced some films obtained with this apparatus.

Fig. 2 represents the working of a self-loading pistol. When inspected in a cinematograph at reduced speed, the hammer is at first seen to close slowly, while powder gases begin to escape. At the same time, the air vibrations set up by the report of the pistol are distinctly seen. The projectile eventually leaves the barrel, thus allowing the bulk of the powder gas to escape. At the same time, the breech block of the pistol opens, and while the locking piston recedes, the empty cartridge is discharged, the locking piston again moves on slowly, and a new cartridge is inserted.

Fig. 3 shows the piercing of a freely suspended ball of moist clay. After gradually approaching, the projectile penetrates the ball, giving rise immediately to a projection of clay particles from the point of impact. The projectile eventually pierces the ball, issuing at its side with a fluttering motion. The film strikingly illustrates the gradual progress of explosion.

In Fig. 4 is represented a freely suspended rubber ball filled with water, which under the impact of the projectile is lengthened enormously, being finally atomized.

Another interesting case, viz., that of a lead tube filled with water and closed at both ends by caoutchouc membrane, is represented in Fig. 5. A self-loading pistol is used to shoot lengthwise with full charge, through this tube, pierced at the top by several small holes. The transmission of pressures in the interior of the water can be distinctly followed by observing the gradual projection of water from the holes. The caoutchouc membranes at the same time bulge out considerably, which phenomenon is of great importance in studying the effects of projectiles, especially in the piercing of bones. Explosion is not completed in less than about 300 individual pictures.

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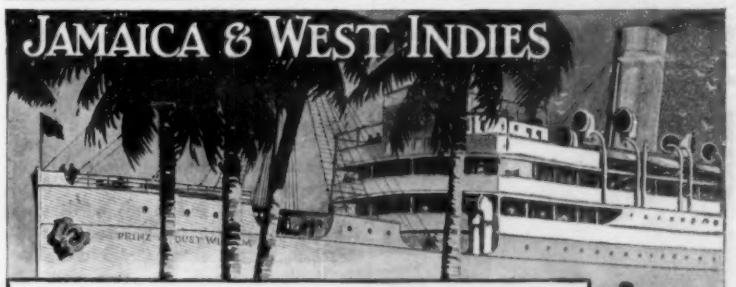

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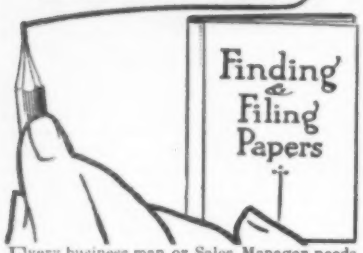

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cording the working of self-loading arms, the effects of explosion of modern infantry projectiles in moist clay and in vessels filled with water, the crushing of bones, the shock of elastic steel balls, the motion of insect wings, etc. All these different phenomena, when reproduced on a projection screen, seem to occur very slowly, and accordingly can be analyzed in all their details.

In Figs. 6 to 8 are reproduced some enlarged pictures showing the behavior of different kinds of ammunition. A striking fact brought out in this connection is that even in the case of the ordinary ammunition, some powder particles (which like all other solid particles discharged from the tube, closely follow the projectile itself) will be visible at the breech of the rifle. Fig. 9 also represents the course of the projectile and powder in the neighborhood of the mouth.

The process above described further enables the speed of translation of a projectile close to the muzzle to be ascertained with remarkable accuracy. To this effect is used a steel drum *T* (Fig. 10) about 25 cm. in width, with a small slot diaphragm parallel to its axis. A series of pictures 1 centimeter in height and 25 centimeters in width is produced through the slot, on a film band running around this drum. The projectile flying past the drum will photograph itself repeatedly, as shown in Fig. 10. The horizontal distance *AB* between the first and last projectile pictures, as well as the vertical distance *BC* having been measured, the tangent of the angle *ACB* will be the average speed of the projectile.

In this manner can be checked and determined any fluctuations in the course of the projectile. If a plate to be pierced by the projectile be placed in front of the middle of the drum, the speed being measured before and behind the plate, the loss in speed due to its piercing can be ascertained. In order to determine any losses in speed due to the resistance of the air and other factors, the speed of the projectile is measured after the process above described, at the beginning and end, respectively, of an extensive free trajectory. To this effect the experimental outfit, as far as the induction coil, condenser, spark gap, drum, and mirror are concerned, is duplicated. (Fig. 1.) After disengaging the pendulum, the shot is started with contact 1, while with 2 the sparking is started only to be interrupted at contact 3 (the interval comprising about 20 sparks). The projectile then continues on its course, and the pendulum goes on working. As it reaches contact 4, the sparking is started anew, being interrupted at 5, after an interval of about 20 sparks.

In concluding, the writer wishes to express his indebtedness to Prof. Cranz for courtesies shown him in preparing this article.

YEAR'S WORK ON PANAMA CANAL.

(*Concluded from page 421.*)

at the Pacific and Atlantic ends of the canal, and the provision and improvement of water supply, hospitals, and dwelling quarters for the large army of officials and employees.

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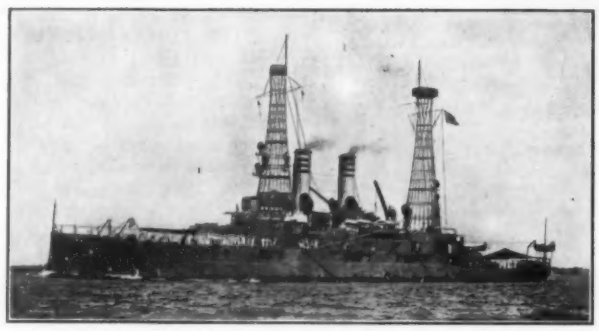
Growth and Opportunities of the Automobile Industry.*

In an address before the students at the opening of the automobile school of the West Side Y. M. C. A., New York, Alfred Reeves, general manager of the

(*Continued on page 430.*)

* Paper read before the School of the Y. M. C. A.



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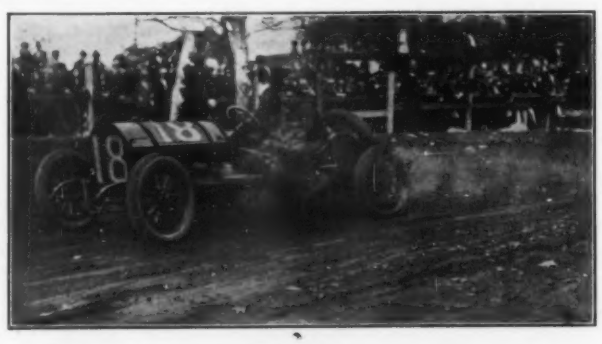

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(*Continued from page 428.*)

Association of Licensed Automobile Manufacturers, gave some interesting figures relative to motor car manufacture, and among other things, he said:

The gentlemen here are about to take part in one of the greatest industries of America—the making of power-driven vehicles, which because of their economic value, are now almost as important in our life as the telephone, the telegraph, and the transportation lines. That the motor vehicle is a time saver, answers fully any question as to its future.

Ten years ago there were about 3,500 machines in America—now there are 400,000. Ten years ago there were 27 factories (200 cars being a record production for any one of them)—now we have almost 100 producing factories, to say nothing of a like number of experimenters involved in the making of motor cars, while an annual production of 15,000 and even 25,000 cars in one factory is not unusual. In a decade, the capital of the automobile and accessory makers has increased from approximately $6,200,000 to $450,000,000, of which $275,000,000 is in motor car factories alone. Ten years ago the number of persons employed in making automobiles and accessories was estimated at 2,000; now there are 278,000 individuals, including those in the salesrooms and garages. Ten years ago there were probably 800 chauffeurs in New York State, which now boasts of almost 25,000 registered drivers. Automobile row in New York in 1900 showed 14 different makes of cars; now there are 84 for you to select from. Ten years ago the average price of cars was $1,100, then it ran up to $2,137 in 1907, after which, with the increase in the number of moderate priced machines, it has come down to $1,545, although the very high grade cars are selling at even higher prices than they were two years ago.

When the fundamental patent covering the modern gasoline automobile was issued to George B. Selden in 1895 even the greatest dreamer had no idea of what 1910 would show in the motor car industry, and it has been all the result of work by able men with ideas. Money has had comparatively little to do with it. Although a wealthy man to-day as a result of his invention, under which 83 manufacturers pay royalties, George B. Selden was a poor man ten years ago. Most of our cars of to-day came not so much from capital, as from mechanical genius in men who began at the bottom rung of the ladder.

Great credit for the present position of the motor car industry is due to those pioneers like Winton, Ford, Haynes, Apperson, Maxwell, Buick, Olds, Duryea, Packard, and a dozen others whose names are now household words. At the same time, however, I would not take credit from the business men of the industry who have financed the manufacturing and marketed the products. They are an important part of the success.

The opportunities are as great as they ever were. Not so much in placing new cars on the market, as in improving the present types. Perfect as our cars appear, with their silent, powerful motors and excellent design and construction, the automobile of ten years hence will show radical changes. The present general design may continue, but think of the improvements that can be made. Improvements in transmission, in greater simplicity and easier control, in increased power, and in economy of fuel consumption, to say nothing of the ever-increasing need of something to improve, to cheapen or to supplant the pneumatic tire.

The character of the men here is such that many of them will be instrumental in making some of those improvements that would be welcomed now, even at the time when motor cars seem to be so nearly perfect, and perform in such faultless fashion.

Motors cars are certain to increase in number, solely on account of their utility,

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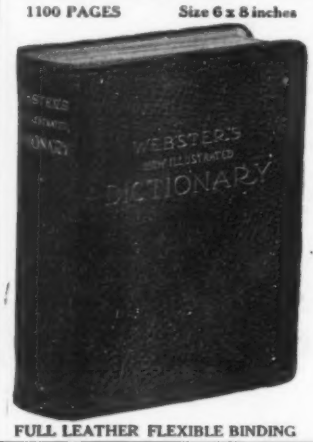

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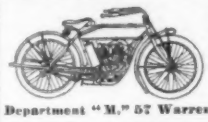

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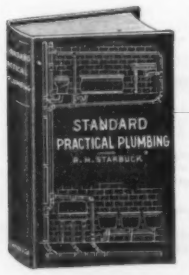

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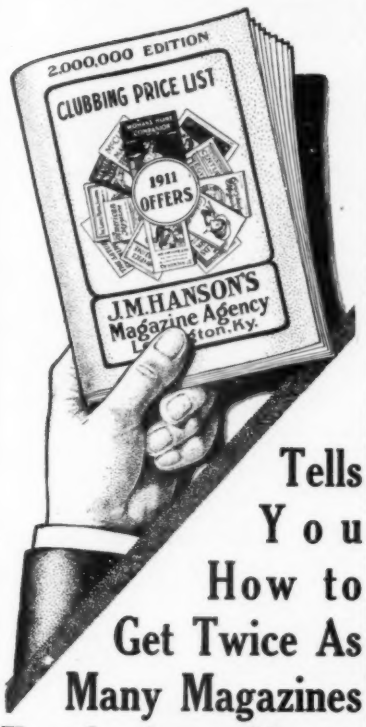

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Naturally, the greatest field for motors in the future, is for the freight carrying cars, which offer the solution of those many problems involved in our present wasteful method of transferring merchandise by horse-driven vehicles. It will bring the well deserved emancipation of our good friend the horse; it will act as feeders to railroads; it will prevent traffic congestion; transport goods more quickly and in greater quantities than is possible with horse-drawn vehicles, and will result in more sanitary streets.

Using a motor car which will carry twice the load, at twice the speed, and requiring only half the space, will be like increasing the widths of streets six times. It must be borne in mind, too, that there are at present 7,000,000 horse-drawn vehicles in use in this country, while an average of 900,000 horse-drawn vehicles are being made every year, to be supplanted by motor cars. In addition, the government census shows 31,000,000 horses, awaiting well-deserved relief from their drudgery.

All this will not be accomplished in a year or two years, yet it is not over optimistic to say that ten years from now there will be as few horse-drawn vehicles on the New York streets, as there were motor cars ten years ago.

You gentlemen will be welcomed to the automobile industry because you bring new ideas. Some of you will invent new things or improve old methods. Some may design cars; others with characteristic American energy, will sell them, while still others, as drivers, will pilot them in a law-abiding manner, transporting their precious burdens in a manner that will earn for the American chauffeur the reputation of being the best in the world. The men here, however, must aim to do better than the average; they must not be ordinary drivers, but expert drivers; not every day salesmen, but star salesmen; not inventors of little things, but producers of big things.

The motor car business, with its almost unlimited field, is one of the most substantial in America, and the rantings of dyspeptic pessimists who have viewed its rapid strides with alarm, cannot halt its growth in this blessed country where every man has the opportunity to prove his worth and to receive the just reward of his efforts.

Tests of road-binding materials on a road in actual use are being made by the Ohio State Highway Department under direction of Mr. James C. Wonders, Commissioner. The road selected is Nelson Avenue, in the outskirts of Columbus, accessible by the Columbus, New Albany and Johnstown Interurban Railway with a 20-minute ride from the city. Sections of this road 16 feet wide and 400 feet long have been treated with the processes offered by different manufacturers, and 17 different sections are now in place. These sections were laid last summer, and the road has been in use since then, carrying a heavy traffic. A report upon these experiments has just been issued by the Highway Department as Bulletin No. 12, but is chiefly devoted to the method of laying the different road-making materials. It is the intention of the department to issue additional bulletins, giving the relative wearing qualities of different materials.

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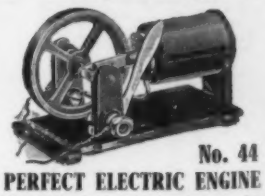

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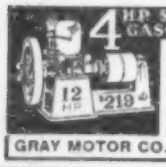

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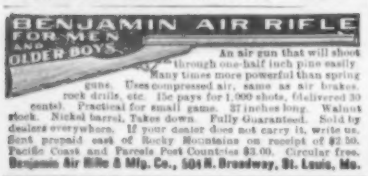

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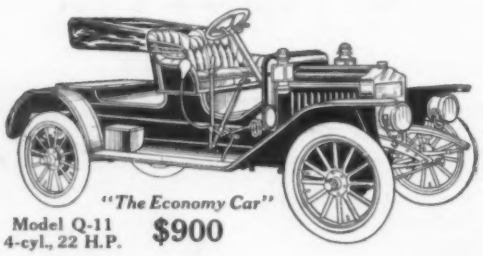

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